SIEMENS

LEVEL TRACER Type D 346

with the Slide-in Chassis Types D 916 to 920, 928

Full Information

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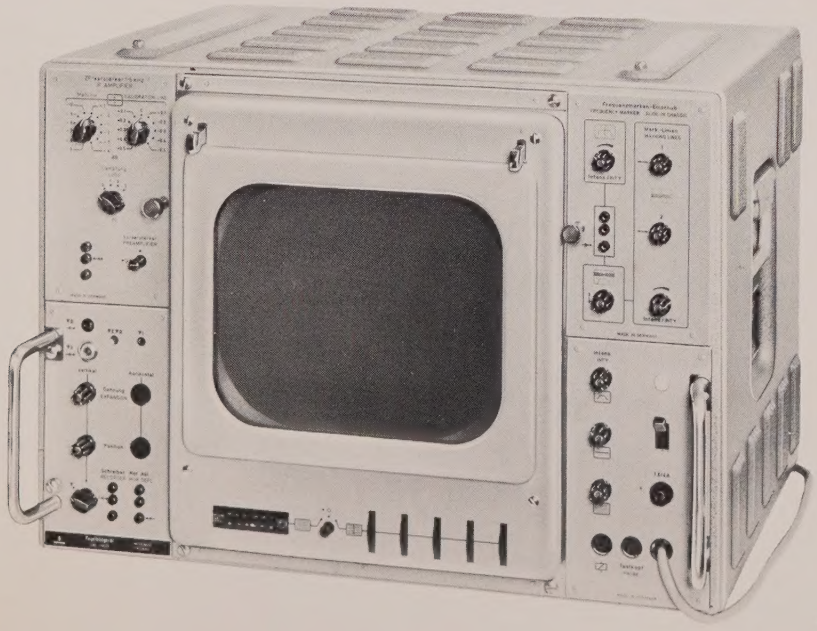
Sawtooth and Horizontal Amplifier, Type Rel ms 35 D 436c1a
IF Amplifier, Type Rel str 3 D 916 (c1a) c2a
Wideband Amplifier
10 kHz to 17 MHz, Type Rel str 3 D 917 (b1a) b2a,3a
0.2 to 1600 kHz, Type Rel str 3 D 918 (a1a) a2a
30 Hz to 30 kHz, Type Rel str 3 D 919 (a1a) a2a
Logarithmic-response IF Amplifier, Type Rel str 3 D 920a 1a,2a
Frequency Marker Slide-in Chassis, Type Rel str 3 D 928a1a

I. APPLICATION

The Level Tracer, Type D 346, a high quality indicating device, is a component part of a number or sweep measuring setups. The measuring result is displayed as a function of the frequency on the screen of a cathode-ray tube. With the aid of interchangeable measuring slide-in chassis (input amplifiers) - for measuring with a wideband there are slide-in chassis with varying frequency ranges and different sensitivities, for selective measuring such as used for the IF of preceding selective level meters - this receiver may be applied for practically all measuring problems encountered. The high degree of accuracy in measuring obtainable with the Level Tracer is due to the large tube screen, the high resolving power and the method of tracing (tracing by scanning lines) which permits electronically adding to the display of the measuring curve, calibrating-level and frequency lines. The measuring accuracy is at least equal to that obtainable with point-by-point measurement; it may even be superior to the latter applied to various problems due to the high resolution available.



LEVEL TRACER D 346

II. ELECTRICAL DATA

A. Level Tracer, Type D 346

Basic Equipment

Display size . . . . . 190 x 170 mm
Persistence Time of the screen phosphor
(brightness drop to 1%) . . . . . approx. 60 sec

Horizontal Deflection

Sensitivity . . . . . approx. 20 mm/V
can be expanded to . . . . . approx. 200 mm/V
Deflecting Voltage required
for full-scale beam deflection (unexpanded) . . . . . 10 V_{p-p}*
Maximum permissible deflecting voltage . . . . . 15 V_{p-p}
Permissible sweep rate . . . . . 0 to 25 Hz
Input resistance at the jack:
Horizontal deflection . . . . . 10 kΩ

* The sweep attachments, Type W933 and W935, supply a triangular wave symmetrical in time with this peak voltage for any sweep width setting and with the sweep rate between 0 and 25 Hz set at the point.

Vertical Indication

Sensitivity . . . . . approx. 10 mm/dB
can be expanded to . . . . . approx. 150 mm/dB
Further data . . . . . given by measuring slide-in chassis

Scales which may be Added to the Display

Frequency (horizontal scale)
with frequency marker slide-in chassis, Type D928

in the form of vertical frequency lines . . . . . controlled by the low-pass signals of the transmit section

or as a modulated signal
with zero crossover . . . . . by the display of the high-pass filter signal of the transmit section

Additionally two static
marker lines . . . . . continuously shiftable
and may be calibrated with frequency marker.

Level (vertical scale)

Calibrated reference line,
settable in steps . . . . . given by
measuring slide-in chassis

Level lines, continuously shiftable
in parallel with the line of reference
and suitable for calibration with the
latter, optionally . . . . . up to 5

Level lines with the aid of
slip-on type level-pattern senders . . . . . up to 8.

Calibration Voltage Outputs (approx. 20 kHz)

for calibration for absolute measurements
Jack ▼ II . . . . . 0 dB (0 Np) across >1 MΩ
Jack ▼ III . . . . . -40 dB (-4.6 Np) across 75 Ω

Connections for Accessories

Standard/unknown alternate presentation switch . . . . . 6.3 V; +20 V dc
+250 V dc

Probe . . . . . -6.3 V dc; +20 V dc
+108 V dc

Recording terminal . . . . . unbalanced 40 V across 100 kΩ for
zero-level indication

B. Level Tracer with Measuring Slide-in Chassis

1. Wideband Amplifier, Type D 917

Frequency range . . . . . 10 kHz to 15 (20) MHz

Measuring range, calibration in:	dB (U_o=0.775 V)	Np (U_o=0.775 V)	dBm (P_o=1 mW into 75 Ω)
related to 0-dB (0-Np) line of reference of	-40 to -5 dB	-4.5 to -1 Np	-30 to +5 dBm
settable in steps of	5 dB each	0.5 Np	5 dB

Frequency response of the indication . . . . . ±0.1 dB (±0.01 Np)

Calibration in:	dB; dBm	Np
Reference line, settable from	+1.5 to -10.5 dB	+0.15 to -1.05 Np
in steps of	0.1 and 1 dB	0.01 and 0.1 Np

Input

unbalanced, coaxial . . . . . jacks 2.5/6

input impedance . . . . . Z = 75 Ω

reflection coefficient . . . . . r ≤ 1%

2. Wideband Amplifier Slide-in Chassis, Type D 918

Frequency range . . . . . 200 Hz to 1.6 MHz

Calibration in:	dB	Np
Measuring range, related to 0-dB (0-Np) line of reference from	-60 to +10 dB	-7 to +1 Np
settable in steps of	5 dB each	0.5 Np each

Frequency response of the indication . . . . . ±0.1 dB (±0.01 Np)

Calibration in:	dB	Np
Reference line, settable from	+1.5 to -10.5 dB	+0.15 to -1.05 Np
in steps of	0.1 and 1 dB	0.01 and 0.1 Np

Input

unbalanced, coaxial . . . . . jacks 1.6/5.6

input impedance . . . . . ≤ 1 MΩ ‖ 60 pF

termination . . . . . can be plugged into parallel jack

3. Wideband Amplifier Slide-in Chassis, Type D 919

Frequency range . . . . . 30 Hz to 30 (100) kHz

Calibration in:	dB	Np
Measuring range, related to 0-dB (0-Np) reference line from	-40 to +20 dB	-4,5 to +2 Np
settable in steps of	5 dB each	0.5 Np each

Frequency response of the indication . . . . . ±0.1 dB (±0.01 Np)

Calibration in:	dB	Np
Reference line, settable from	+1.5 to -10.5 dB	+0.15 to -1.05 Np
in steps of	0.1 and 1 dB	0.01 and 0.1 Np

Input . . . . . unbalanced, three-pole jack

input impedance . . . . . ≥ 1 MΩ

termination . . . . . can be plugged into parallel jack

4. IF Amplifier Slide-in Chassis, Type D 916

Frequency range . . . . . 1 to 5 kHz

Input level required for 0-dB (0-Np) indication

switch-selected . . . . . 0 or +20 dB (0 or +2.3 Np)

additionally variable in three attenuation steps of . . . . . 1 dB (0.1 Np) each

Reference line settable from . . . . . +1.5 to -10.5 dB (+0.15 to -1.05 Np)

Input . . . . . unbalanced, three-pole jack

input impedance . . . . . 15 kΩ

further data (measuring range) given by . . . . . preceding selective level meter

5. Logarithmic IF Amplifier Slide-in Chassis, Type D 920

Input frequency, switch-selected . . . . . 50 or 100 kHz

Display range without expansion . . . . . 100 dB (10 Np)

Input level required for 0-dB (0-Np) indication . . . . . 0 dB (0 Np)

Reference line settable from . . . . . 0 to -100 dB (0 to -10 Np)

in steps of . . . . . 10 dB (1 Np)

Input . . . . . unbalanced, jacks 1.6/5.6

Input impedance . . . . . 600 Ω

Further data (measuring range) given by . . . . . preceding selective level meter

Mains Connection . . . . . 110, 130, 220 (230), 240 ±10%, 47 to 60 Hz; approx. 180 VA

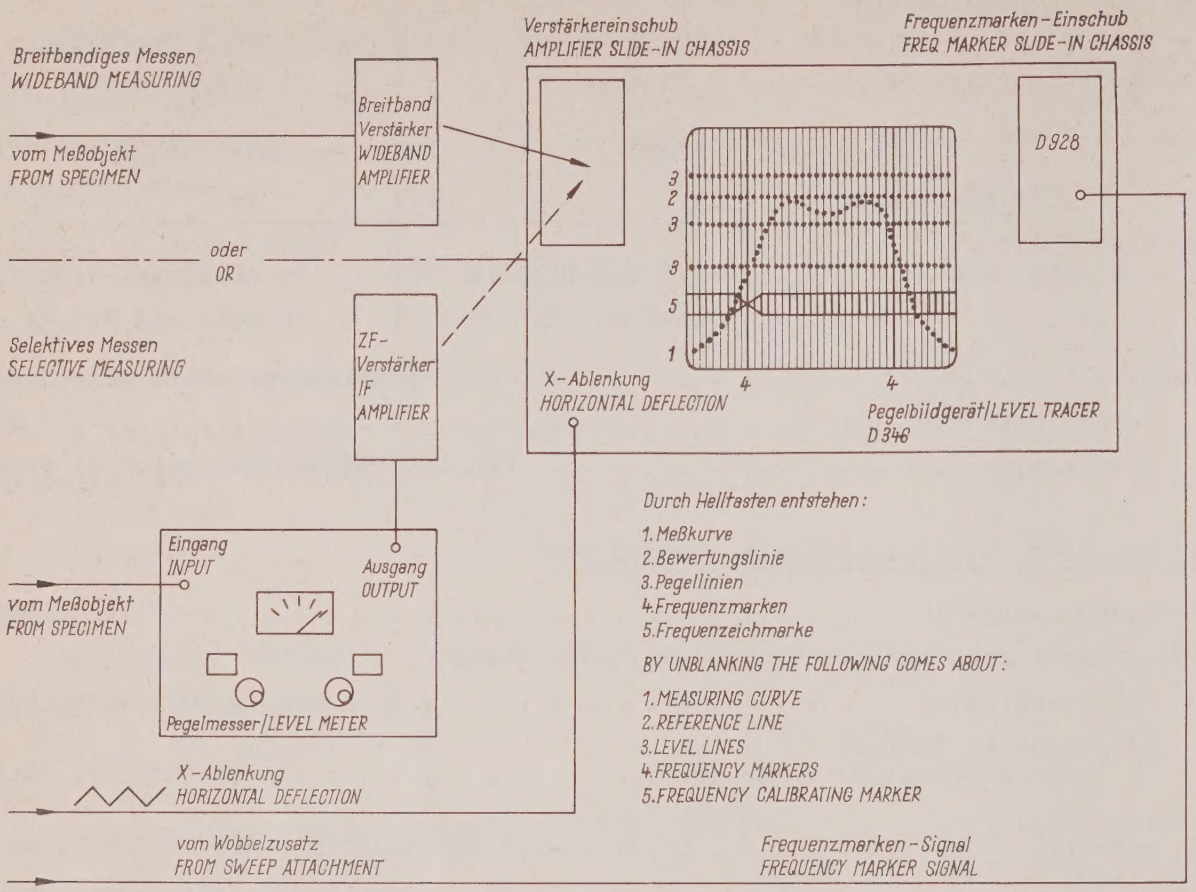


Bild 1 Empfangsteil, Geräteübersicht und Schirmbild-Beispiel
FIG.1 RECEIVING SECTION, EQUIPMENT SURVEY AND TYPICAL SCREEN DISPLAY

A. General Layout (Fig. 1)

In the level tracer the measured quantity is displayed on the screen of a CRT as a closed trace. For the adaptation of the unit to various measuring problems and frequency ranges, interchangeable measuring slide-in chassis are available which differ in their frequency range and sensitivity.

The CRT employed has a large screen area; its great screen persistence results in a continuous trace even in connection with a slow sweep.

The method of tracing is largely similar to that commonly used in TV systems, the scanning lines, however, passing in a vertical direction and initially remaining dark. The measuring trace and the lines for its evaluation are unblanked point-by-point. With the aid of a calibrated, variable reference line, a level scale consisting of horizontal lines can be produced which may comprise up to five level lines (with a slip-on level-pattern sender up to eight lines). Furthermore, several frequency lines can be added to the display, covering the full screen height. By the simultaneous representation of measuring trace and auxiliary lines many causes of faults, including parallax, are avoided.

The input signal is amplified and rectified in the measuring slide-in chassis for the level tracer. In addition these slide-in chassis are provided with voltage dividers for setting the sensitivity and the reference line.

The wideband amplifiers, Type D 917 (frequency range 10 kHz to 17(20) MHz), Type D 918 (frequency range 200 Hz to 1.6 MHz) and Type D 919 (frequency range 30 Hz to 30(100) kHz) are available for the measuring of small attenuation differences in large frequency ranges (VF, CF), such as with wideband amplifiers, cables or separating filters. When carrying out selective measurements, a selective level meter with an automatic tuning control precedes the level tracer. The IF measuring slide-in chassis, Type D 916 (1 to 5 kHz) or the logarithmic slide-in chassis, Type D 920 (50 or 100 kHz) serve to adapt the IF output of the level meter to the level tracer.

Frequency markers are required for the evaluation of the measuring trace. The signals for the frequency markers are supplied by the transmit section of the measuring setup. There is a choice between a pulse signal filtered via a low-pass filter and a frequency band with an amplitude, falling in the vicinity of the zero crossover of the beat note (i.e. the frequency marker point) - a high-pass filter signal.

The pulse signal is amplified in the frequency marker slide-in chassis, limited and rectified. The pulse thus formed unblanks a few lines of the graticule, causing a frequency line to originate which extends vertically across the CRT screen. The width of the frequency line must have a satisfactory ratio in relation to the width of the swept band. Should the frequency line no longer be sufficiently accurate due to an inadequate sweep range or excessive sweep rate (appearance of double lines), the high-pass filter signal may be resorted to in its place. The band will then be traced on the CRT screen with the frequency marker point, characterized by a constriction.

Additionally, two shiftable vertical lines may be represented by means of pulses independently generated from the signal to be measured in the frequency marker slide-in chassis. These can be calibrated with the respective frequency marker and then utilized as a frequency scale.

The vertical range of indication can be so expanded that a sensitivity of approx. 150 mm/dB is obtained on the CRT screen. This high degree of sensitivity is an advantage, for example, when very minute level differences are to be measured with the comparison method. The standard/unknown alternate presentation switch, Type B 946, serves this purpose, and synchronously with the sweep frequency alternately switches over the input of the equipment from the measuring probe to a secondary standard (for details refer to Supplementary Equipment, p.1-27).

For frequently recurring measuring problems, such as for example the testing of large numbers of equal specimens, there are plug-in type level-pattern senders (Type B 945), which can give rise to up to eight preset level lines (for details see Supplementary Equipment, p. 1-27).

The Tracing Method

The cathode ray is deflected in a vertical direction by means of a 20-kHz sawtooth wave generated in the basic unit, and in a horizontal direction by means of a triangular wave, variable between 0.01 and 25 Hz, supplied by the transmitting section. The set of vertical lines, arising from this, is not normally visible and is only unblanked where the measuring trace or auxiliary lines intersect the scanning lines.

In Fig. 2 the path of the cathode ray has been traced on the CRT screen in a simplified form. The measuring trace and horizontal auxiliary lines originate through the lining up of a large number of unblanked dots within the line graticule, whereas vertical auxiliary lines originate through the unblanking of a small number of scanning lines.

With the deflection frequency of 20 kHz and a sweep frequency of 1 Hz, each trace is composed of 10,000 dots in every frame. Even at the highest sweep rate of 25 Hz, 10,000 : 25 = 400 image dots will be traced per screen trace.

The vertical position of each unblanked dot is determined by a comparator. The latter compares the amplitude of the voltage to be written with the rising edge of the 20-kHz sawtooth wave. The voltage step resulting during the instant of equal voltages is differentiated and amplified repeatedly. A brief pulse originates which unblanks the cathode ray for the fraction of a vertical deflection period during this instant. For the purpose of tracing out a vertical scanning line (frequency marker), the unblanking takes place for the duration equivalent at least to one vertical deflection period (Fig. 2).

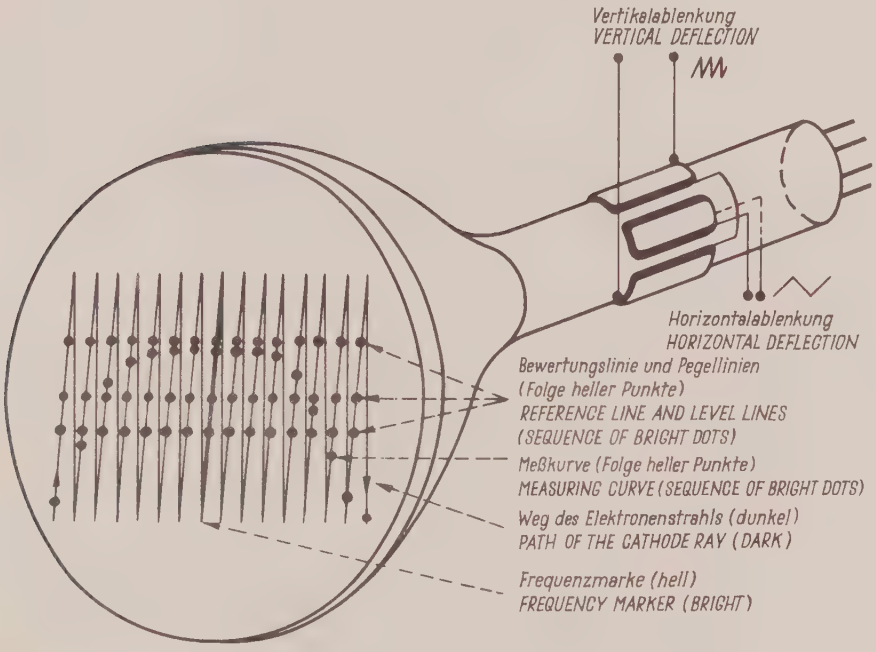


FIG. 2 TRACING METHOD, PATH OF THE ELECTRON BEAM

The functioning of a comparator may be seen from Figs. 3 and 4. The 20-kHz sawtooth wave is applied at A, the rectified voltage of the signal to be measured being applied at B. As long as the potential at A is lower than that at B, the diode remains blocked; the potential of B is applied at C.

Should the potential at A exceed that at B, the diode becomes conductive, the voltage at C rising in accordance with the curve as drawn. The point in time t1 at which the voltage rise sets in, depends on the magnitude of the voltage at B ($t1 = f(U)$). By the differentiation of this function, a voltage step originates at D and by further differentiation the unblanking pulse at E.

The second differentiation takes place in a differentiating amplifier whose output circuit - a pulse shaping circuit - supplies the unblanking pulse.

For every auxiliary (level) line an individual comparator circuit is required. The sequence in time of the pulses inside a rising edge of the 20-kHz sawtooth voltage determines the position of the written dots in the Y-axis, where the position of the rising edge in the X-axis is given by the horizontal deflection voltage (Fig. 5).

The comparator circuits for the level lines work into a common load resistor R (Fig. 6). A staircase wave originates at R, corresponding to the voltages adjusted on the potentiometers which the common differentiating amplifier converts into a pulse train.

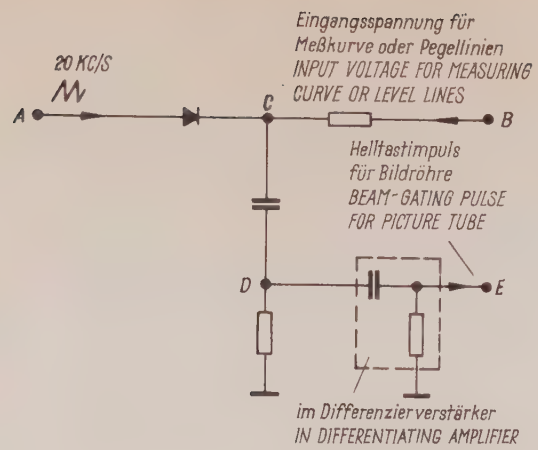


Bild 3 Schaltung des Komparators
FIG.3 CIRCUIT DIAGRAM OF THE COMPARATOR

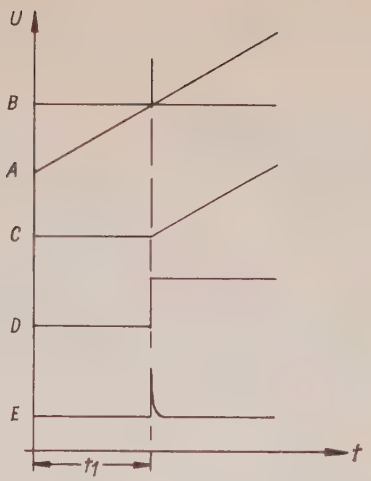


Bild 4 Impuls-Zeit-Plan
FIG.4 PULSE TIME SCHEDULE

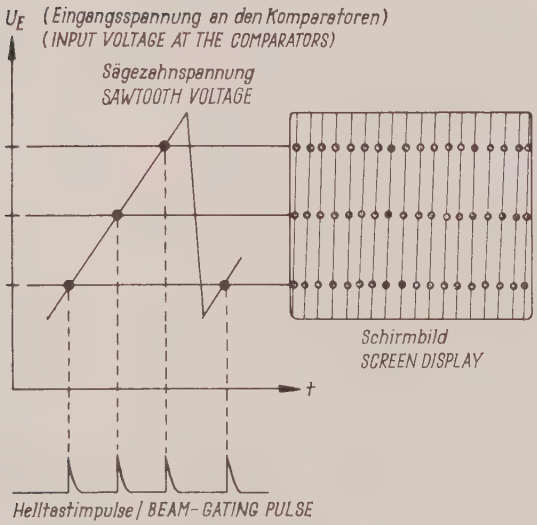


Bild 5 Zeitfunktion der Helltastimpulse, gezeichnet für drei Pegellinien
FIG.5 TIME FUNCTION OF THE BEAM-GATING PULSES FOR THREE LEVEL LINES

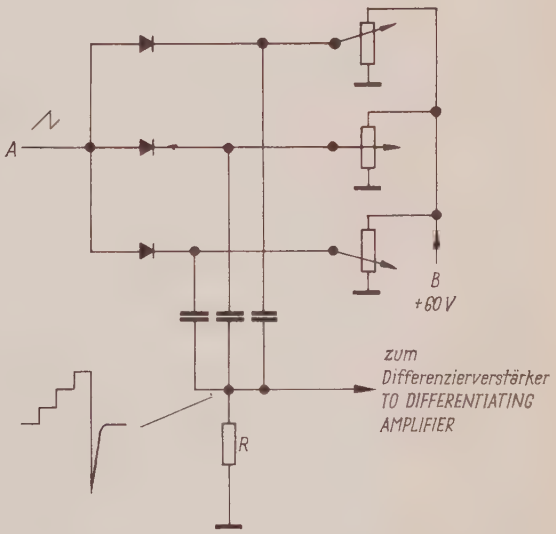


Bild 6 Schaltung der Komparatoren für die Pegellinien
FIG.6 CIRCUIT DIAGRAM OF THE COMPARATORS FOR THE LEVEL LINES

C. Layout of the Equipment

1. Total Layout (Fig. 7)

The input voltage amplified and rectified in the measuring slide-in chassis first reaches a dc amplifier, the gain of which may be calibrated optionally either to the sensitivity given by the reference line or which may be adjusted corresponding to the expansion of the measuring signal (up to ten times). Comparator 1 converts the respective amplitude value of this dc voltage into a time function. Further differentiation occurs in the differentiating amplifier 1. The signal voltage thus converted into a pulse train reaches the cathode of the CRT via an adder circuit. The pulses unblank point-by-point the dots in the vertical beam deflection. The lined-up dots produce the measuring trace.

The five continuously adjustable horizontal level lines originate simultaneously and in the same manner, through unblanking pulses via comparators 3 to 7 and differentiating amplifier 3. Furthermore a line derived from zero potential, the-oo line, is originated with the aid of comparator 9. The comparison voltages required for the comparators are tapped off potentiometers P1 and P5 which are connected to a regulated dc voltage. The magnitudes of the comparison voltages can be varied with P1 and P5 in such a manner that the level lines can be shifted over the entire height of the CRT screen. In place of the built-in comparators for the level lines, a plug-in type of level-pattern sender, Type B 945, can be connected. These senders have been arranged for a maximum of eight level lines which can be permanently set and which may thus be individually calibrated for recurring measuring problems. In addition to the level lines, a reference line (measuring line) is traced via a further comparator and differentiating amplifier (comparator 2, differentiating amplifier 2). The latter can be set in calibrated steps via voltage dividers in the amplifier slide-in chassis. With their aid a calibration of the continuously shiftable level lines may be carried out.

For frequency marking with the low-pass filter signal of the transmit section, this signal is amplified in the frequency marker slide-in chassis, limited and rectified. The pulse formed in this manner reaches the cathode of the CRT and unblanks one or several lines point-by-point, resulting in a vertical frequency line.

For frequency marking with the high-pass filter signal of the transmit section (frequency-modulated band with a constriction in the frequency marker point), this signal requires conversion into a time function corresponding to the pulse frequency (20 kHz) for the purpose of reproducing it on the CRT screen. Comparator 8 serves this purpose which derives the unblanking pulses

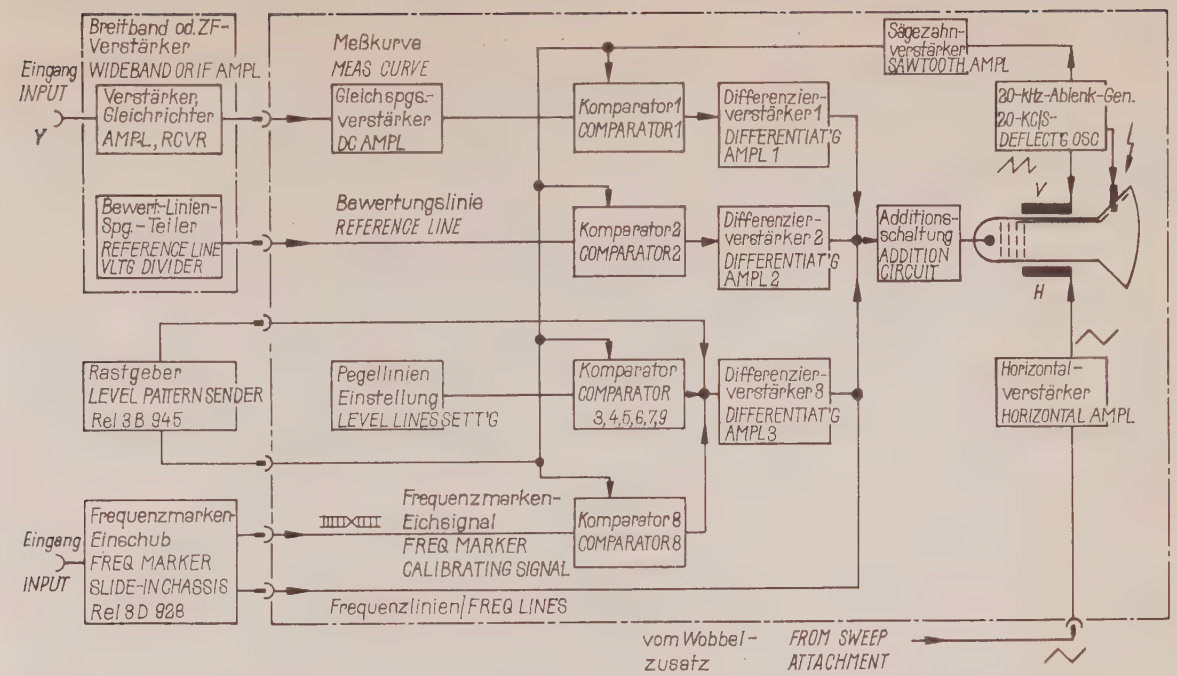


FIG. 7 BLOCK DIAGRAM OF THE LEVEL TRACER

from the respective instantaneous value of the high-pass filter signal and transfers these to differentiating amplifier 3.

In addition to these frequency markers derived from signals of the transmit section, a comparison circuit generates two pulses in the frequency marker slide-in chassis as a function of the horizontal deflection. By means of these pulses, two vertical lines are unblanked on the CRT screen which can be independently shifted across the full width of the screen. Having been calibrated with the frequency line or the zero crossover of the high-pass filter signal, a marking with two further frequencies is feasible with the use of these lines.

The sawtooth current required for the vertical deflection in the deflecting coil is produced by a 20-kHz generator in the high voltage section. Its voltage is also fed into the comparators as a comparison voltage via an amplifier. The high voltage (12 kV) for the CRT is supplied by the scanning-line transformer, and obtained from the high inductive voltage originating during the sawtooth flyback.

The control voltage from the sweep attachment of the transmit section which is proportional to the frequency variation is employed for the horizontal deflection. This triangular wave, symmetrical in time, controls the current for the deflecting coil via the horizontal amplifier.

2. The dc Amplifier

The voltage to be measured supplied by the wideband or IF amplifier for the voltage comparison in the comparator is inadequate in respect of the high accuracy of measurement required. For this reason it is further amplified in the dc amplifier. The amplification of the latter must be very constant, since gain variations would displace the measuring trace on the CRT screen in relation to the level scale, independently calibrated by the dc amplifier, and so lead to errors in measurement. The required stability is obtained with the aid of a feedback amplifier, symmetrically arranged in push-pull, and with carefully regulated supply voltages. Fig. 8 illustrates the simplified layout of the dc amplifier.

The cathodes of tubes 8 and 10, situated in the input circuit, carry a potential of approximately -170 V. The grids are fed with approximately -160 V via potentiometer R8 and the balancing resistors in the rectifier circuit of the amplifier slide-in chassis. In order to make the vertical deflection for the input voltage 0 V (level - ∞) coincide with the -∞ line added into the display via comparator 8, the quiescent current of tubes 9 and 10 can be accurately adjusted by means of " ▼I" with the aid of a supplementary voltage. A stabilized voltage wave of the 20-kHz generator which is rectified via diodes Gr1 and Gr2 serves as a voltage source for this purpose. The gain of the dc amplifier is determined by the voltage feedback (R20 and R23) as well as the resistor network between the cathodes of tubes 9 and 10.

In order that level measurements are feasible with the aid of a level scale, based upon the level reference line together with the level lines, the gain must be brought to a precisely defined value. For this purpose a calibration voltage is applied to the input of the measuring slide-in chassis and the traced line calibrated to the level rating line 0 dB by adjusting the gain with potentiometer P11 " ▼II, III" in the dc amplifier.

In the second position of switch S1 ("EXPANSION VERTICAL") the feedback may be continuously reduced with P10 in such a manner that gain and thus also the variation in indication per dB will rise to ten times its original value. In this manner also very small variations in level up to approx. 0.01 dB can be read.

With the potentiometer P8, situated in the horizontal amplifier, it is possible for the measuring trace or the section of particular interest of this trace to be shifted back into the screen display when expansion is employed.

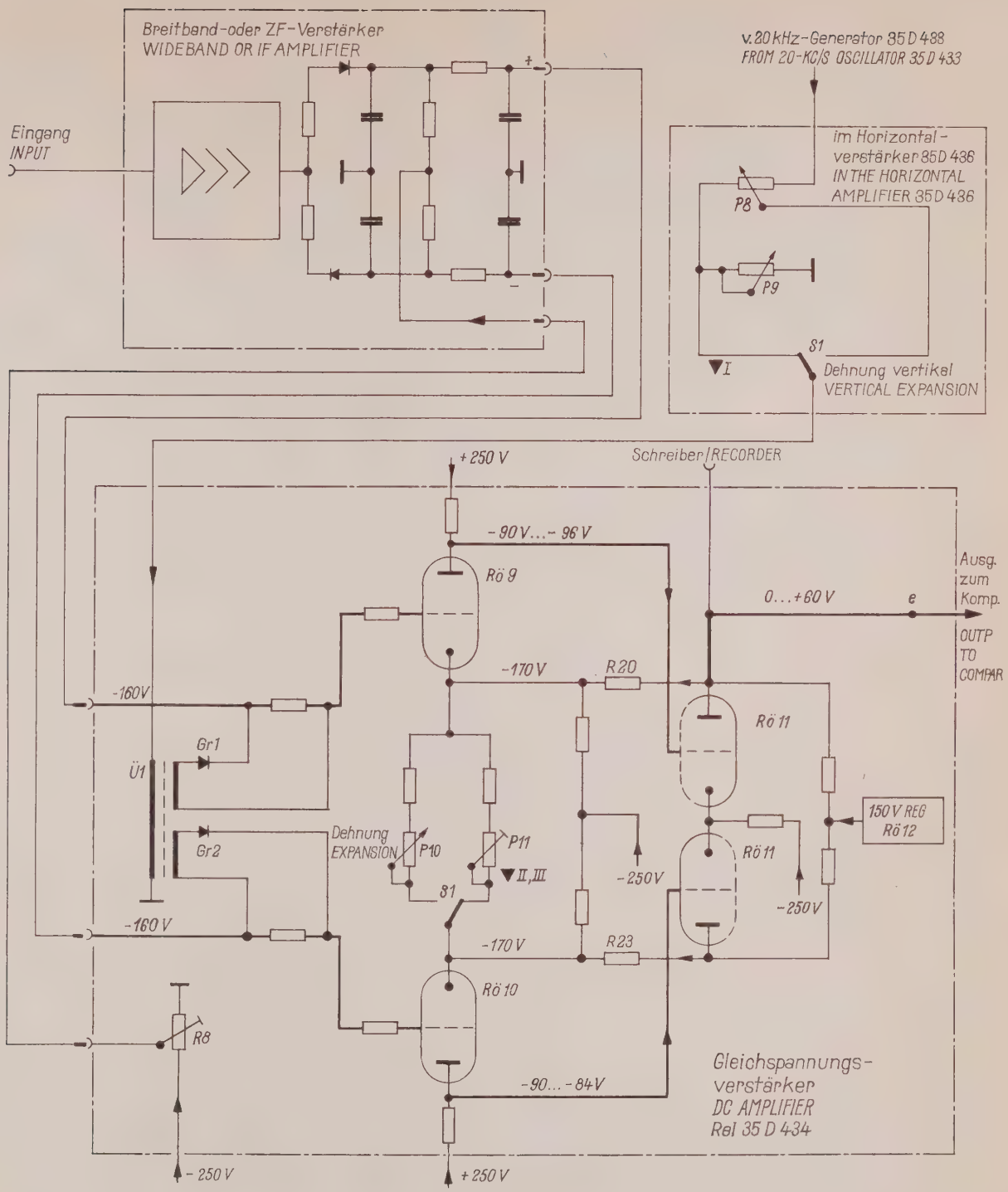


Bild 8 Grundschaltung des Gleichspannungsverstärkers
FIG. 8 BASIC CIRCUIT DIAGRAM OF THE DC AMPLIFIER

3. The Sawtooth Amplifier

The second voltage required for voltage comparison in the comparators is the 20-kHz sawtooth voltage of the deflection generator. Due to the variable load caused by the comparators (refer to "Functioning of the Comparators", p.1-10), the sawtooth amplifier precedes the comparators as an impedance converter (T2, T3). The former has been arranged as a feedback dc amplifier with two cathode-follower output stages connected in parallel.

Circuit configuration: refer to overall circuit diagram Rel str 3 D 346 in the circuit diagram section. The sawtooth amplifier has been physically combined with the horizontal amplifier in the subassembly, Type Rel 35 D 436.

4. The Horizontal Amplifier

The horizontal amplifier supplies the deflecting current required for the horizontal deflecting coils of the CRT. The triangular voltage wave generated in the sweep attachment controls this amplifier. Fig. 9 illustrates a simplified circuit diagram of the amplifier.

The triangular voltage is applied to the grid of a buffer stage and from the cathode reaches a dc amplifier, equipped with transistors, via the voltage divider P7. With the aid of P7, the magnitude of the voltage and thus also an expansion up to ten times the display width may be set. In order that each segment may be shifted onto the CRT screen with horizontal expansion, there will be found at the grid of the first tube, in addition to a triangular voltage wave, another dc voltage derived from the stabilized 20-kHz voltage and settable with P6.

A limiter circuit has been inserted in front of the first transistor which prevents overloading of the amplifier, i.e. cuts off, with the expansion activated, the deflection extended beyond the CRT screen.

Due to the metallical coupling of the transistors of the dc amplifier, the supply voltages of individual transistors must be "stacked" onto each other. This "stacking" is achieved by the Zener diodes at transistor 2 in the emitter and at transistor 3 in the base.

Via the common emitter resistor (R18, 19) of stages Ts1 and Ts3 a current feedback is produced.

The magnetizing current for the deflection coils is supplied by the two power transistors Ts3 and Ts5. The currents of the two transistors pass through the deflecting coils in opposite directions, their sum being constant. When both currents are equal, they cancel each other in the coil, and the cathode-

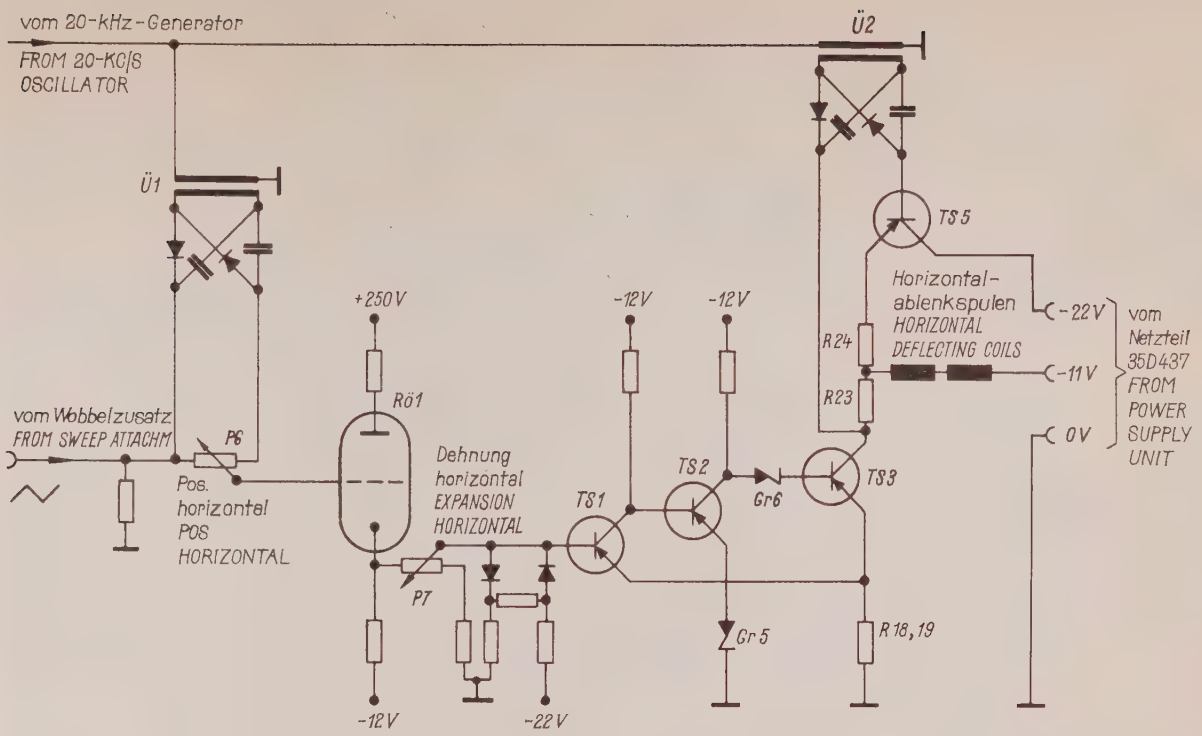


FIG. 9 BASIC CIRCUIT DIAGRAM OF THE HORIZONTAL AMPLIFIER

ray is not deflected horizontally. When the collector current of transistor Ts3 rises due to an applied drive signal, transistor Ts5 is controlled in the opposite sense by this current, and its current decreases. Conversely, the current of this transistor rises with a decreasing applied signal. Transistors Ts4, 6 and Ts8, 9 not shown in the simplified circuit diagram (refer to str 3 D 346 in the circuit diagrams section), serve the purpose of regulating the supply voltages.

5. Differentiating Amplifiers (Fig. 10)

The voltage steps derived in the comparators from the input voltage, the various auxiliary voltages and the 20-kHz-sawtooth voltage in each case have reached one of the differentiating amplifiers. The voltage steps are amplified and differentiated in several stages by means of the current feedback of the low frequencies.

In the anode circuit of the last stage there is a resonant circuit for final pulse shaping. This circuit functions as follows: the negative pulse supplied by the penultimate stage (T14, section I) cuts off the no-signal anode current of the last tube (T14, section II) and thus excites

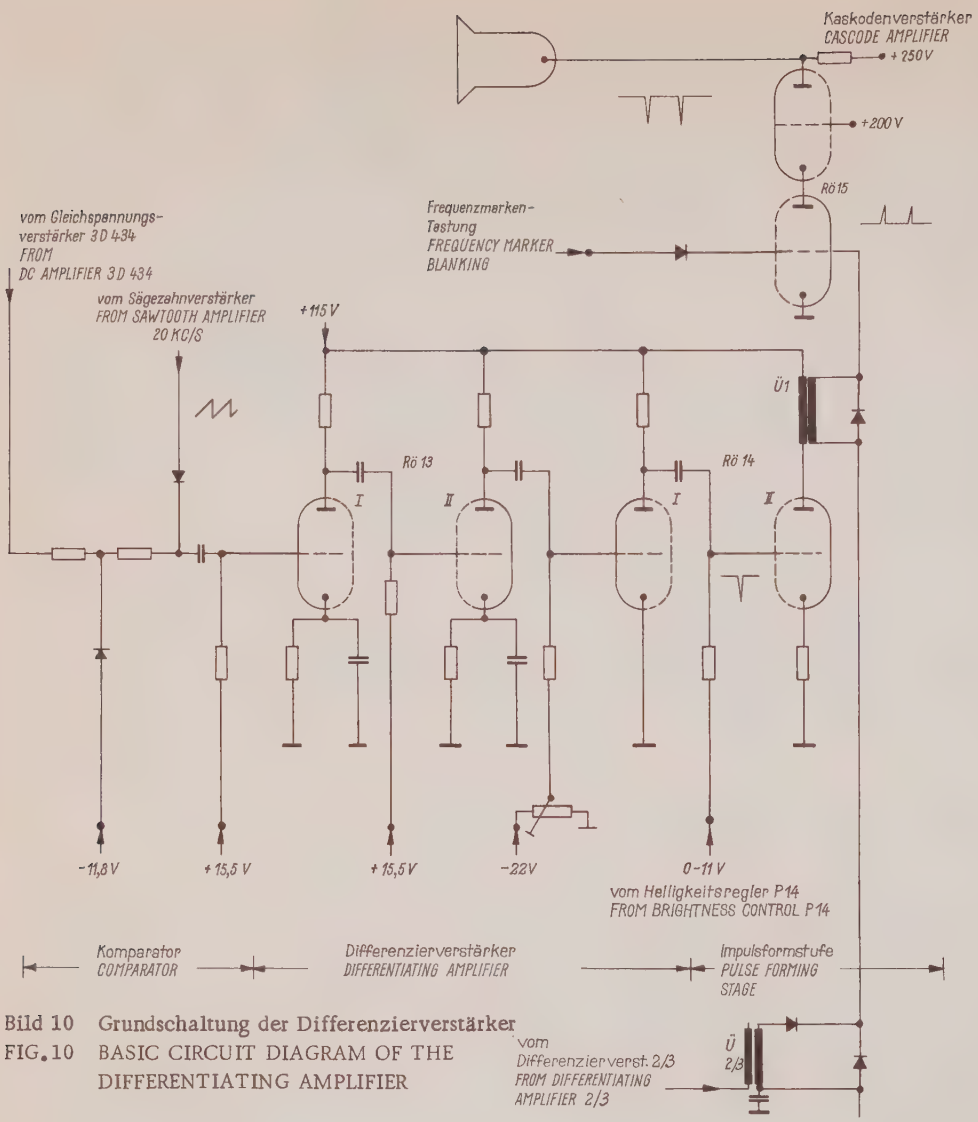


Bild 10 Grundschaltung der Differenzierverstärker
FIG. 10 BASIC CIRCUIT DIAGRAM OF THE DIFFERENTIATING AMPLIFIER

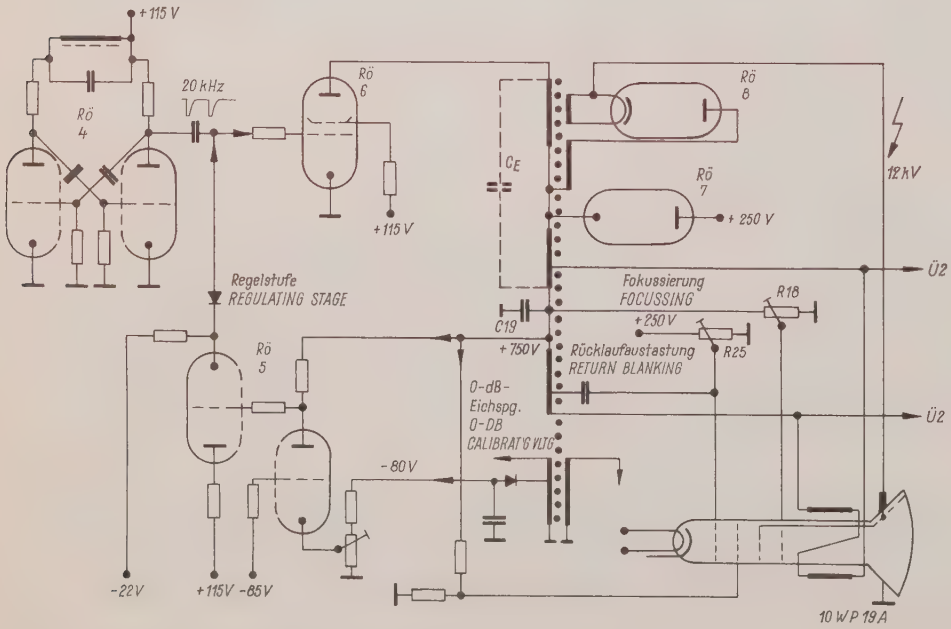


Bild 11 Grundschaltung des Hochspannungsteils
FIG. 11 BASIC CIRCUIT DIAGRAM OF THE HIGH-VOLTAGE SECTION

oscillation in the anode resonant circuit. The frequency of the oscillation is governed by the inductance and residual capacitance of the coil. A diode connected across the resonant circuit permits only the first positive alternation to originate and short-circuits the negative alternation. The resonant circuit is dampened to such an extent that in practice only a positive pulse originates. The magnetude of this pulse depends on the magnitude of the no-signal anode current and is a governing factor for the brightness of the image spot; for this reason it may be adjusted with P14 by altering the grid bias.

The three types of lines to be represented - measuring curve, level reference line (measuring line) and level lines - must allow agreement to be established for measurement or calibration, i.e. they must be independent from each other during their periods of origin. For this reason separate differentiating amplifiers are required for the three types of lines. Then, however, each of the three types of lines may be represented with different brightness which considerably contributes towards the clarity of the display.

Only the pulse-shaping stages of all three differentiating channels have been joined together. From here the pulses reach the cascode amplifier (T15) and then proceed to the cathode of the CRT.

6. The High-Voltage Section (Fig. 11)

The multivibrator (T4) generates the 20-kHz-sawtooth voltage required for various purposes. The subsequent "scanning-line final tube" (T6, E 236 L) supplies the current for the scanning-line transformer. The latter has output coupling windings for the vertical deflection of the CRT, for the sawtooth amplifier which supplies the voltage for the comparators, for flyback blanking and for calibrating voltages. The high voltage for the CRT originates via a high voltage winding followed by a rectifying tube (T8, EY 86). At the same time the anode voltage for the scanning-line final tube is increased by a voltage peak originating during the scanning-line flyback.

By means of a control stage (T5, E 88 CC) whose output voltage controls the working point of the scanning-line final tube (T6), a high degree of stability is obtained for all voltages taken from the high voltage section.

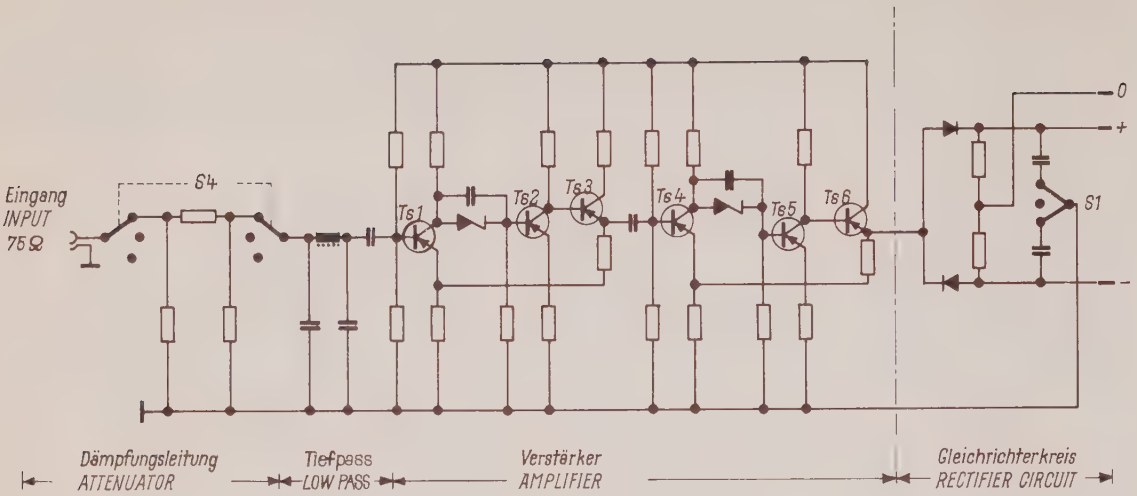


Bild 12 Grundschaltung des Breitbandverstärkers D 917
FIG.12 BASIC CIRCUIT DIAGRAM OF THE WIDEBAND AMPLIFIER Type D 917

D. The Measuring Slide-in Chassis

For the purpose of adapting the level tracer to the measuring problem in hand, different wideband and IF amplifier slide-in chassis are available. They are allied with the main fields of application by frequency and level, and match the corresponding sweep measuring setups.

1. The Wideband Amplifier Slide-in Chassis

a. The 10-kHz to 17-MHz Wideband Amplifier, Type D 917

In conjunction with this amplifier the level tracer serves, for example, as a wideband detector in the carrier-frequency measuring setup, Type M 701 (10 kHz to 15 MHz). Thus it is particularly suitable for the measuring of small attenuation differences, e.g. of the amplitude/frequency response of wideband amplifiers or of pass-band distortion of filters. A significant feature is the low frequency response of the amplitude ($\pm$1% in the entire frequency range). The setup of this amplifier is illustrated in Fig. 12.

From the output of the specimen, the voltage under test is fed into the amplifier via the built-in attenuator (Z = 75 Ω). Attenuation can be adjusted in seven steps of 5 dB (0.5 Np) each from 0 to 35 dB (0 to 3.5 Np). The subsequent six-stage amplifier incorporates transistors, Type 1 N 1143. It possesses a gain of 40 dB (4.5 Np); thus for a full-scale deflection at the level tracer, a measuring range of -5 dB to -40 dB (-1 to -4.5 Np) is obtained.

By means of the selected circuit with feedback over three stages each, the supply voltages regulated by a transistor (Ts7), as well as the uniform and careful layout (printed circuitry), a very low amplitude/frequency response of the amplifier throughout the frequency range is ensured. The output voltage is taken off at the emitter of transistor 6, rectified and fed into the dc amplifier in the level tracer via plug-in contact strips.

The time constant and thus the buildup transient times of the rectifier circuit can be switch-selected, in order to satisfy the varying requirements produced by the wide range in variations for the sweep and measuring frequency.

With the aid of switches S2 and S3 (not shown in the figure; refer to overall circuit diagram, Rel str 3 D 917) a divider fed from a regulated voltage source can be switched for the adjustment of the level reference line in eleven steps of 1 dB (0.1 Np) each and ten steps of 0.1 db (0.01 Np) each.

By means of this voltage which is adjustable in steps and the level reference line (measuring line) controlled by it, either a calibrated scale can be established within the measuring range or the curve, as illustrated, evaluated by measuring out.

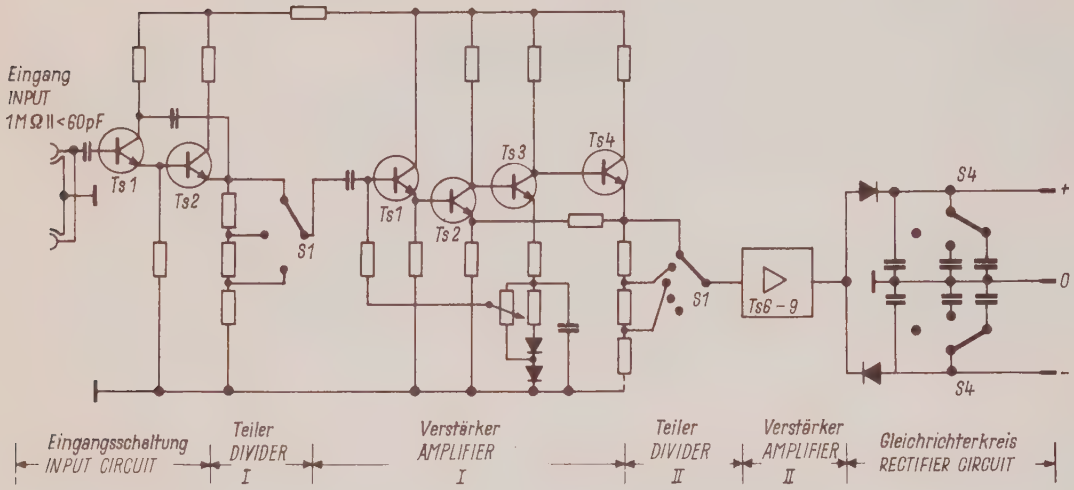


FIG. 13 BASIC CIRCUIT DIAGRAM OF THE WIDEBAND AMPLIFIER, TYPE D 918

b. 0.2 to 1600-kHz Wideband Amplifier, Type D 918 (Fig. 13)

This amplifier is employed for the wideband measuring of small attenuation differences in conjunction with the carrier-frequency sweep measuring setup 0.2 to 1600 kHz, Type M 704. It is characterized by a small amplitude/frequency response within its transmitted range. The unbalanced input has a high impedance; a termination can be connected to a parallel jack. Via a plug-in type balancing transformer, measurements also of balanced specimens may be carried out up to a frequency of 600 kHz.

A two-stage input circuit equipped with transistors is followed by a voltage divider which can be switched in two 20-dB steps. The voltage divider in turn is followed by a four-stage amplifier, equally equipped with transistors. A further voltage divider with six 5-dB steps supplements the sensitivity switching facility, permitting the measuring range to be adjusted together with the 20-dB divider which is mechanically linked with the 5-dB divider, related to the 0-dB (0-Np) reference line from -60 to +10 dB or in the case of the Neper model, from -7 to +1 Np.

The voltage of the divider output is amplified in a second wideband amplifier (with the same circuit configuration as the first amplifier) to the level required by the dc amplifier in the level tracing receiver and rectified via two diodes connected in push-pull. The time constant of the rectifier circuit can be switched for adapting it to the respective sweep rate and the lowest measuring frequency.

The amplifiers embodying feedback, temperature compensation and regulated supply voltages provide great stability and provide the flat gain required for high measuring accuracy.

The level reference line can be adjusted in the same manner as in the slide-in chassis, Type 917, but between +1.5 and -10 dB (+0.15 and -1.05 Np).

c. The 30 to 30,000-Hz Wideband Amplifier, Type D 919

This amplifier is employed for wideband measuring in conjunction with the audio sweep measuring setup, Type M 703 (frequency range 30 to 30,000 Hz) and also in conjunction with level meter, Type D 342.

The layout closely corresponds to amplifier slide-in chassis, Type D 918. The measuring range for full-scale deflection on the level tracing receiver extends from -40 dB to +20 dB (-4.5 to +2 Np) and may be adjusted in steps of 5 dB (0.5 Np).

The unbalanced input has a high impedance; terminations can be connected to a parallel jack. Via a balancing transformer measurements on balanced specimens may also be carried out. The level reference line is similarly adjustable with this amplifier slide-in chassis between +1.5 and -10.5 dB.

2. The IF Amplifier Slide-in Chassis

a. The 1- to 5-kHz Amplifier, Type D 916 (Fig. 14)

This amplifier adapts the outputs of the selective level meters of the 15-MHz sweep measuring setup (Type M 701) and those of the 1.6-MHz sweep measuring setup (Type M 704) to the level tracer. Selective measuring is considered appropriate whenever voltages of other frequencies might tend to introduce errors into the measuring result and whenever the high sensitivity of the selective level meter is required for measuring.

The translated voltage under test is applied via an input divider which can be switched (three steps of 1 dB (0.1 Np) each) to a cathode follower, consisting of two tube sections connected in parallel. From there the voltage reaches a rectifier circuit via a transformer and subsequently the dc amplifier of the tracing receiver via plug-in contact strips.

The amplifier (with an amplification of approx. 10) which can be switched in with S4, has been provided for level meter, Type D 344, of sweep measuring setup, Type M 704, since the latter produces less IF voltage.

In this slide-in chassis, too, two voltage dividers for the level reference line are built in (refer to circuit diagram, Rel str 3 D 916).

b. The 50/100-kHz Logarithmic-Response Slide-in Chassis, Type D 920 (Fig. 15)

This measuring slide-in chassis is suitable for the measuring of specimens with great differences in attenuation. It may also be connected to level meters having a 50-kHz or 100-kHz output with an adequately great intensity range, e.g. Type D 354 or D 335g.

The voltage to be measured is amplified in ten cascaded stages; the gain per stage is 10 dB. Via a special winding of the output transformer (Fig. 16) the voltage to be measured from each stage also reaches a rectifier circuit, the output voltage of which is limited by a Zener diode. The dc outputs are connected in series, causing the dc voltages of all stages to be added together. This sum of all voltages reaches the dc amplifier of the level tracer via a time-constant network which can be switched. Due to stepped limitation, a logarithmic indication covering a range of 100 dB appears on the CRT screen.

The two intermediate frequencies possible of 50 or 100 kHz can be selected with the aid of an easily accessible switch in the slide-in chassis. Here the inductance of a resonant circuit situated between the 4th and the 5th amplifier is switched.

A voltage divider for the level reference line - in this instance it can be switched in 10-dB steps - is also built into this slide-in chassis.

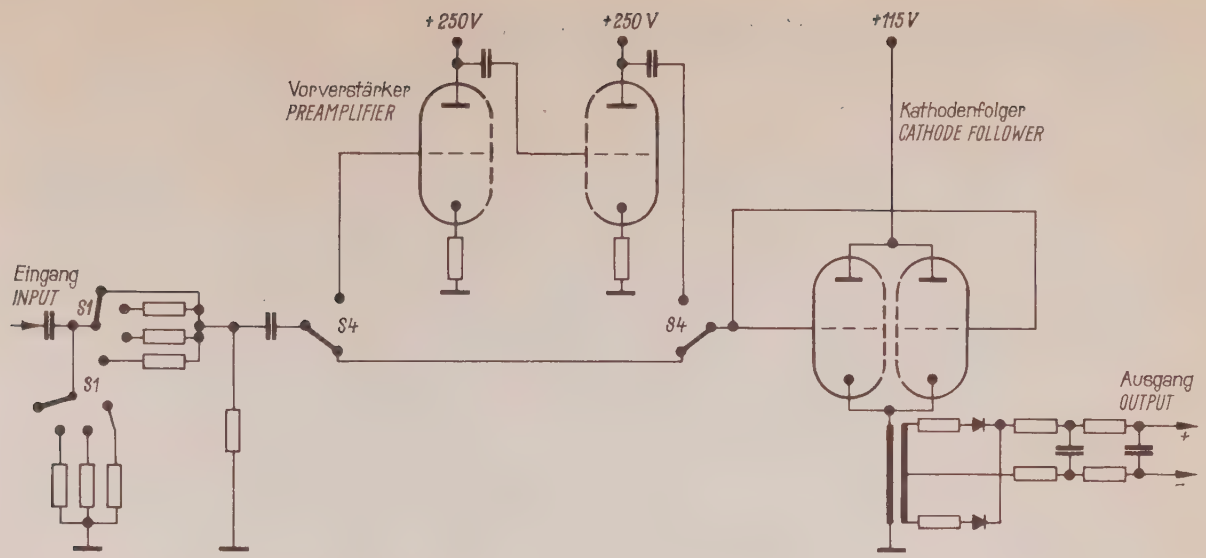
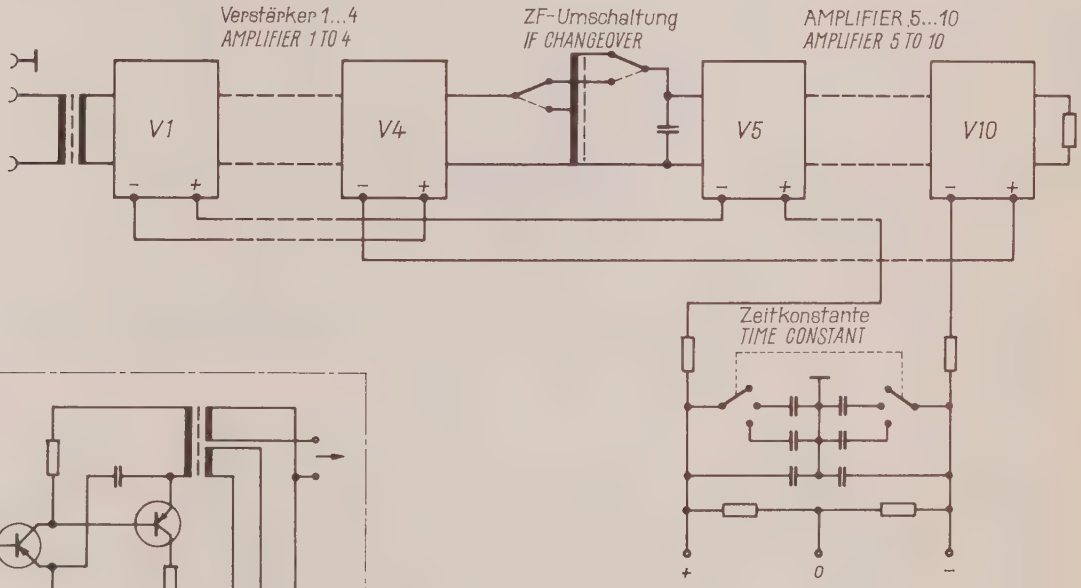


Bild 14 Grundschaltung des ZF-Verstärkers D 916
FIG.14 BASIC CIRCUIT DIAGRAM OF THE IF AMPLIFIER Type D 916



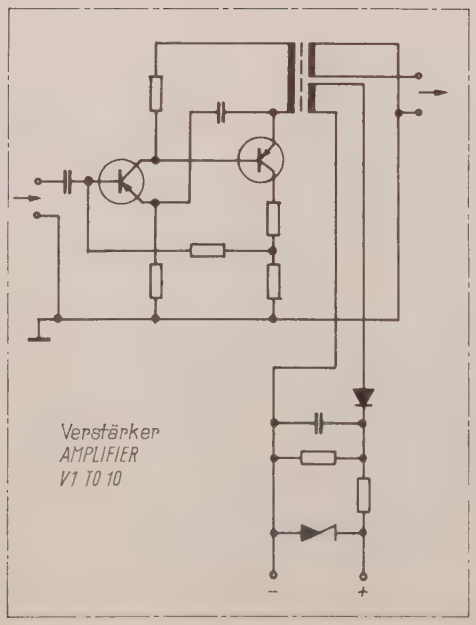


Bild 15 Blockschaltbild des Logarithmier-Verstärkers D 920
FIG.15 BASIC CIRCUIT DIAGRAM OF THE LOGARITHMIC AMPLIFIER Type D 920

Bild 16 Grundschaltung der Verstärker-Stufen des Logarithmier-Verstärkers
FIG.16 BASIC CIRCUIT DIAGRAM OF THE AMPLIFIER STAGES OF THE LOGARITHMIC AMPLIFIER

E. Frequency Marker Slide-in Chassis, Type D 928

The frequency markers originate from the signals supplied by the transmit section (see p. 1-07). The low-pass filter signal is fed into a push-pull cathode-follower stage with phase inversion and the capacitors C35, C36 connected to the pushpull limiting circuit with Zener diodes Gr11 to Gr14 (see Fig. 17). The subsequent rectifier circuit Gr15/Gr16 only permits the positive half (pushpull rectification) of the signal to pass, leading to the generation of a pulse. The latter reaches the cathode of the CRT via an amplifier in the level tracer and there unblanks the cathode-ray for one or several vertical deflecting periods.

With the aid of control P5 the magnitude of the pulses can be varied and thus the brightness of the frequency lines adjusted.

With the high-pass filter signal, this signal - an envelope curve with zero crossover - is traced on the CRT screen; the zero crossover is the frequency measuring point and corresponds to the frequency adjusted at the level oscillator. The signal is superposed with a dc voltage, variable between -12.5 and +67 V, in the frequency marker slide-in chassis after traversing a buffer stage (Fig. 18). By varying this voltage (with P4), the envelope curve may be displaced vertically across the entire display height, for the purpose of preventing the relevant parts of the measuring trace from being concealed and that the frequency measurement of trace points can be carried out accurately by the forming of the point of intersection between measuring trace and the zero crossover. The further conversion of the signal into unblanking pulses occurs in the basic equipment (see p. 1-10).

Two shiftable, vertical lines serve for the establishing of a frequency grid which may be calibrated with the frequency marker or line. The unblanking pulses for these vertical marking lines originate in the frequency marker slide-in chassis (Fig. 19) in the following manner: the triangular-shaped X-axis deflecting voltage is compared in a difference amplifier with a dc voltage. When the instantaneous value of the deflecting voltage U_{st} equals the dc voltage U_g, it follows that the voltage drop across the two anode resistors is equal and the potential difference between anodes is 0 V. Only at this instant the two diodes connected between the anodes and connected in parallel with opposite polarities (Gr1, Gr2) are of high impedance. These are part of the subsequent RF oscillator. The latter is in a position to oscillate when both diodes are of high impedance ($U_{st} = U_g$), and the oscillations cease when the resistance of one of the diodes becomes low ($U_{st} \neq U_g$). The voltage wave of the oscillator is rectified (Gr9, Gr10); the resultant pulses are the unblanking pulses establishing the marker line, extending in a vertical direction. A second difference amplifier, connected to the same oscillator, controls the pulses for the second marker line.

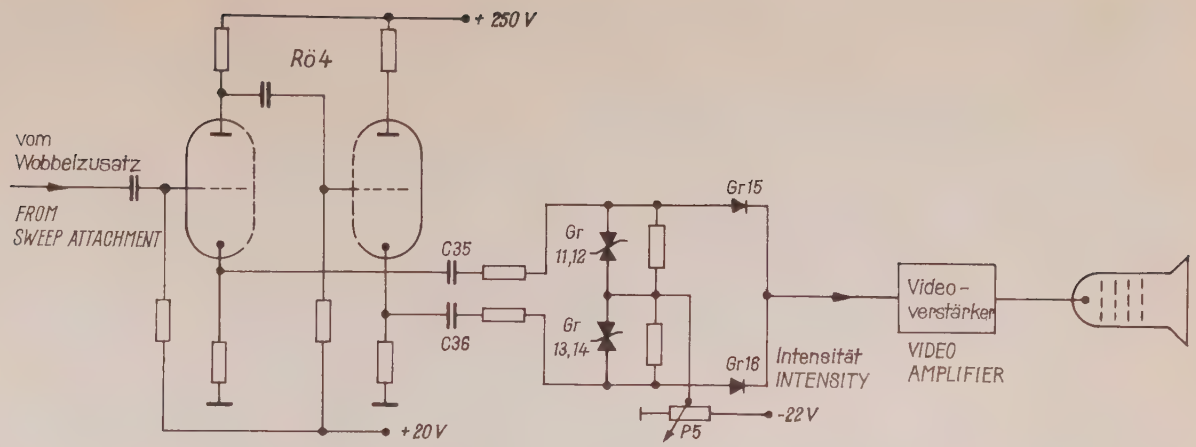


Bild 17 Grundschaltung für Frequenzlinien (Tiefpaßsignal)
FIG. 17 BASIC CIRCUIT DIAGRAM FOR FREQUENCY LINES (LOW-PASS SIGNAL)

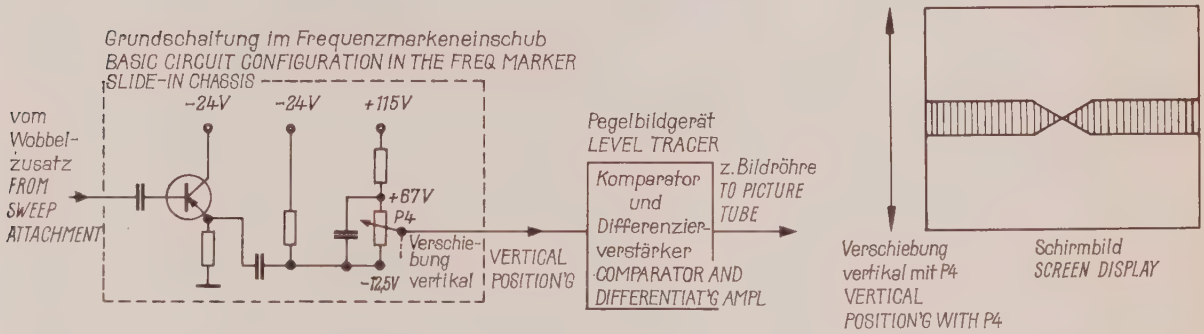


Bild 18 Frequenzmarke (Hochpaßsignal) im Empfangsteil
FIG. 18 FREQUENCY MARKER (HIGH-PASS SIGNAL) IN THE RECEIVING SECTION

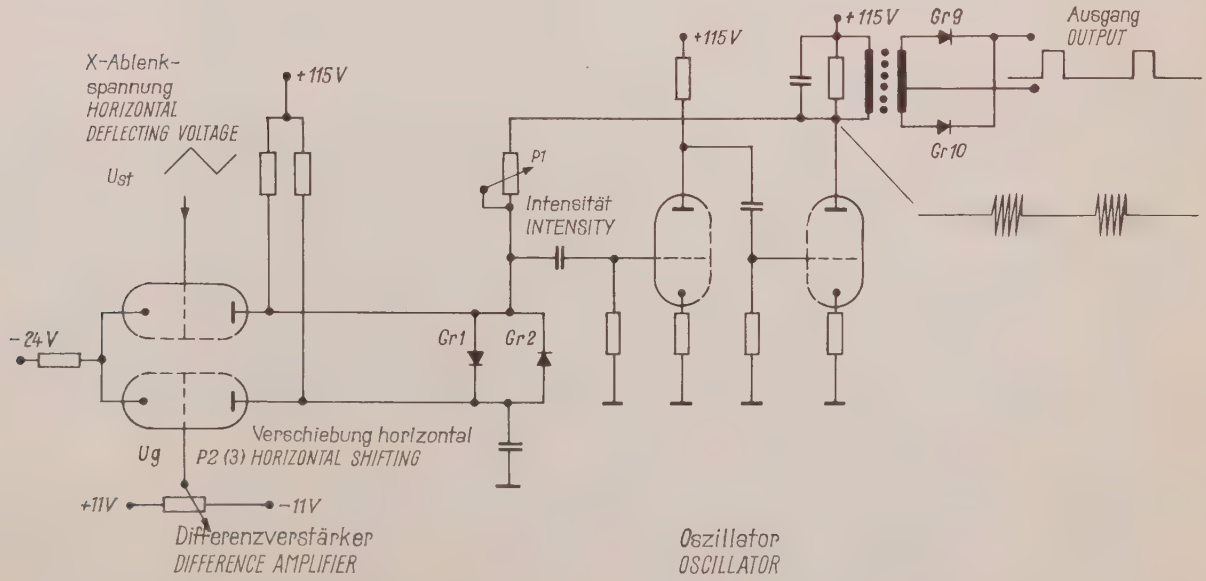


Bild 19 Grundschaltung für Markierungslinien
FIG. 19 BASIC CIRCUIT FOR THE MARKING LINES

The voltage U_{st} simultaneously serves as the control voltage for the frequency sweep action of the sweep oscillator and as the voltage for the horizontal deflection of the CRT. This explains that the pulse derived from the voltage comparison at a constant voltage U_g always will unblank a line in the same place on the CRT screen, the width of which is independent of the sweep width. By altering voltage U_g (with P2/3), the point in time for the initiation of the pulse can be changed in such a manner that the marking line may be shifted across the full width of the CRT screen.

F. Attachments

1. Level-Pattern Sender, Type B 945

The level scale adjustable on the CRT screen by means of potentiometers P1 to P5 must be readjusted for every alteration in the measuring problem. In the case of frequently recurring measurements, it is advisable that calibrated scales are available at all times.

In this connection plug-in type level-pattern senders (Type B 945) are available with eight built-in comparators and which thus can give rise to up to eight level lines. At the open level-pattern sender, the position of the level lines required for a certain measuring problem can be adjusted with a screwdriver on the comparator potentiometers. Through the interchange of the senders, the scale for the respective problem is then immediately restored. Apart from a saving in time, there is the greater reliability of measurement, since errors due to the unintentional moving of the adjusting potentiometers or false calibration are avoided.

2. Alternate-Presentation Switch, Type B 946

The sensitivity of the level tracer can be increased with the aid of the adjustable expansion to such a degree that variations in level of 0.01 dB can still be recognized with ease. The comparison method (the standard/unknown method) provides the possibility of exploiting this high sensitivity over wide frequency ranges. With this method the standard N and the measuring specimen X are switched with the aid of the transfer switch, Type B 946, at the sweep rate so that during the forward and return sweep, the curves of N and X are traced alternately on the CRT screen.

Since this method of measuring concerns pure comparative measurements, the residual level distortion, such as the frequency responses of the individual measuring devices involved, as well as the errors in the leads with identical layouts may be ignored and in this manner very minute attenuation differences measured between the specimen and the standard.

When carrying out series tests, the comparison method is most advantageous, since the time-consuming evaluation by measurement and reading of results becames superfluous when aligning the specimen; attention need only be paid to the fact that both curves match. By virtue of its small dimensions, the alternate-presentation switch readily fits into the measuring layout without long leads. Its reflection coefficient is so small that no additional measuring error occurs. Further details will be found in the instructions for use for the alternate-presentation switch, Rel gesamt 3 B 946 ...

3. Measurements of the Reflection Coefficient

The level tracer permits all measurements to be carried out which can be traced back to voltage measurement. A frequent application in practice is the determination of reflection coefficients. For this purpose there are reflectometer bridges which are partly incorporated in the sweep measuring setups and partly can be supplied as an accessory, such as for example for the frequency range of 30 kHz to 15 MHz, the reflectometer bridge, Type R 132, with which reflection coefficients of a few tenths of a percent can be measured (regarding this, refer to instructions for use, Rel gesamt 3 R 132).

IV. DESIGNATIONS, DIMENSIONS AND WEIGHTS

Item		Order ref.No.	Dimensions in mm	Weight appr.kg.
Level tracer, Type D 346 . . .		Rel 3 D 346c1a	556x394x517	35
(Basic equipment)				
Accessories				
20	Tube	E88CC (CCa)	-	-
1	Tube	E236L	-	-
1	Tube	PY81	-	-
1	Tube	EY86	-	-
1	Stabilizer tube	85A2	-	-
1	Picture tube	10WP19A (Dumont company)	-	-
1	Fuse link, 1.6 A	D41571-M1600-E2	-	-
1	Indicating lamp	Fg 1p 62bc	-	-
1	Bag with spares, containing:			
2	Fuse link, 1.6 A for 220/240 V	D41571-M1600-E2	-	-
3	Fuse link, 4 A for 110/130 V	D41571-M4000-E2	-	-
2	Fuse link, 0.125 A for high-voltage section .	D41571-M125-C2	-	-
2	Indicating lamp	Fg 1p 62bc	-	-
1	Lamp extractor	C44121-A9-C1	-	-
Required for operating the equipment				
1	Frequency marker slide-in chassis	Rel 3 D 928a1a	111x165x235	1
1	Wideband amplifier slide-in chassis, 10 kHz to 17 MHz			
	model for -40 to -5.0 dB	Rel 3 D 917b2a	111x165x235	1.5
	model for -30 to +5.0 dBm	Rel 3 D 917b3a	111x165x235	1.5
	model for -4.5 to -1.0 Np	Rel 3 D 917b1a	111x165x235	1.5
Alternatively:				
1	Wideband amplifier slide-in chassis, 0.2 to 1600 kHz			
	model for -60 to +10 dB	Rel 3 D 918a2a	111x165x235	1.0
	model for -7 to +1 Np . .	Rel 3 D 918a1a	111x165x235	1.0
alternatively:				
1	Wideband amplifier slide-in chassis, 30 Hz to 30 kHz			
	model for -40 to +20 dB	Rel 3 D 919a2a	111x165x235	1.0
	model for -4.5 to +2 Np	Rel 3 D 919a1a	111x165x235	1.0

Item	Order ref. No.	Dimensions in mm	Weight appr.kg.
Alternatively:			
1 IF amplifier slide-in chassis 1 to 5 kHz			
model in decibels	Rel 3 D 916b2a	111x165x235	1.0
model in nepers	Rel 3 D 916b1a	111x165x235	1.0
Alternatively:			
1 Logarithmic-response amplifier slide-in chassis			
model in decibels	Rel 3 D 920a2a	111x165x235	1.0
model in nepers	Rel 3 D 920a1a	111x165x235	1.0
For the level tracer as required:			
Level-pattern sender, Type B 945	Rel 3 B 945a1a	50x110x45	0.5
1 standard/unknown alternate-presentation switch, Type B 946	*	150x98x168	1,0
1 Probe, Type B 938, 10 kHz to 17 MHz	*	170x27 dia.	0.5

* see data sheet covering auxiliary measuring gear for audio and carrier frequencies, ref. NF/TF.

I. PREPARATION

The equipment leaves the works connected for operation from a 220-V ac mains. When operating the equipment from ac mains differing in voltage, the chassis must be taken from its cabinet and the voltage adjuster S4, now accessible, on the right hand side of the equipment in the power supply unit, switched over to the existing mains voltage. For mains voltages of 110 or 130 V, insert a 4-A fuse link in the fuse element on the front panel.

In line with the safety regulations of the "VDE" (Association of German Electrical Engineers), equipment for operation from the mains, the touch potential of which may exceed 65 V to ground in the event of a fault, must be equipped with a connection for a non-fused protective ground conductor.

This type of equipment therefore possesses a power cable with a non-fused grounding conductor and a three-wire plug embodying a grounded safety contact (known as "Schukostecker"), used in connection with a socket outlet with a non-fused grounding connection (known as "Schukodose"). The plug-in connection and the conductor section for the non-fused conductor must be equal to those of the live conductors.

Should this safety plug have to be exchanged against a different local type of plug with a ground connection, connect the three wires (red, gray and black) to the mains as follows:

with non-polarized connector systems

red wire to the non-fused conductor connection,
gray and black wires to the live conductor connections;

with polarized connector systems in mains with phase wire and neutral conductor:

red wire to the non-fused conductor connection,
gray wire to the neutral conductor connection,
black wire to the "phase" connection.

In addition the equipment possesses a special ground terminal (⏚) on the front panel, connected to its chassis.

Before connecting the level tracer to the mains, insert the appropriate slide-in chassis for the measuring task in hand (refer to "Electrical Data").

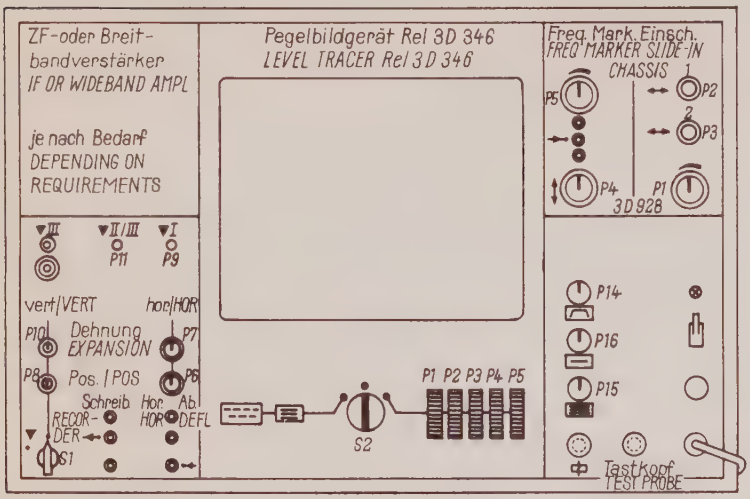


FIG. 1 LEVEL TRACER CONTROLS

A. Control Settings (Fig. 1)

1. Brightness Control (basic unit, bottom right-hand side, Fig. 2)

Set brightness of all lines just only at such a level which will suffice for making a clear reading, in order that the CRT screen, which is damage-susceptible due to its long afterglow, will not be strained unduly.

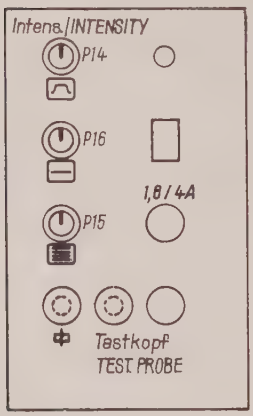


FIG. 2 BASIC UNIT, RIGHT-HAND SIDE

The following can be set independently of each other:

with control P14 the brightness of the measuring curve

with control P16 the brightness of the reference line

with control P 15 the brightness of the level lines

The measuring curve is the line determined by the input voltage (the level to be measured).

The reference line (measuring line) is a line derived from a regulated voltage which can be set in defined dB or Np steps. It serves for the calibration of the level lines.

The level lines consist of five horizontal lines which can be moved over the entire height of the CRT screen screen by means of controls P1 to P5, and with which a scale can be established. In place of the five shiftable lines, up to eight level lines can be generated with the plug-in type "level-pattern sender".

2. Controls for Setting Horizontal and Vertical Positions and Expansion (basic unit, bottom left-hand side, Fig. 3)

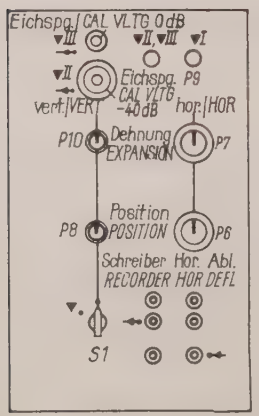


FIG. 3 BASIC UNIT, LEFT-HAND SIDE

The resolution in respect of frequency is determined by the sweep width, i.e. the sweep width prevailing and adjusted at the sweep generator is traced across the full width of the CRT screen. Additionally, a "horizontal expansion" can be set with control P7 and with control P6 "Position" the relevant frequency segment can be shifted onto the CRT screen.

The sensitivity of indication can be increased to such an extent with control P10 "vertical expansion", unlike with the calibration given by the level reference line, that approx.1.5 cm display height corresponds to

a level difference of 0.1 dB. For measuring with expansion, turn switch S1 from position "▼" to position "vertical".

Initially move the measuring curve with control P8 "position vertical" into the lower part of the CRT screen, since with the adjustment of expansion by means of control P10, the measuring curve is displaced in an upward direction and the required displacement can be observed at the same time.

B. Calibration

Approximately 15 minutes after switching on the equipment, it may be calibrated. During this preparatory period turn the brightness controls P14, P15, P16 counterclockwise (dark) or feed the deflection voltage from the sweep attachment via the horizontal deflection jack, in order to prevent the luminous spots from producing burns on the CRT screen.

1. Calibration I (-∞ line)

In the level tracer equipment a measuring amplifier slide-in chassis must already have been inserted; no signal, however, may be applied to its input.

Turn switch S2 "level lines" in the basic equipment to the "off" position (central position).

Turn brightness control for measuring curve (P14) and level lines (P15) to the right until two luminous spots or - with the deflection voltage connected - two horizontal lines become visible.

Set switch S1 to position "▼ calibration".

With control P9 "▼I" make both points or lines coincide.

Should it be intended to carry out this calibration process during measurement, then disconnect the voltage to be measured from the measuring amplifier slide-in chassis. The level line -∞ is recorded in all switch positions of S2.

2. Calibration for Wideband Measuring (▼II, ▼III)

Only required, if the absolute level is to be measured with wideband reception. Insert the respective wideband amplifier unit required in the level tracer. The calibration voltage is available at jacks "▼II" (0 dB) and "▼III" (-40 dB). Connect the input of the wideband amplifier, Type D 917 to jack "▼II", and the input of wideband amplifiers, Type D 918 or D 919 to jack "▼III". Do not connect the parallel jacks of the input at the amplifiers, Type D 918 or D 919.

Set the switches of the respective slide-in chassis to calibration positions "▼II" or "▼III". Disconnect level lines (switch S2 in the basic equipment) (center setting).

Adjust brightness control for the measuring curve and the reference line (P14/16) in such a manner that two spots become visible in the upper third of the CRT screen or two lines, with the deflection voltage connected. Then bring both spots or lines to coincidence with the aid of calibration control P11 "▼II, ▼III".

3. Calibration for Selective Measuring

With selective reception, carry out the calibration for the measuring of the absolute level together with the level tracer. In this connection utilize the calibration voltage of the level meter and adjust the measuring curve onto the 0 dB (0 Np) reference line.

4. Calibration of the Level Lines

Below the picture tube will be found the controls P1 to P5 for the vertical displacement of the five level lines. With switch S2 there is a choice between these level lines and the level lines, controlled by the plug-in level-pattern sender (up to eight lines), or the level lines switched off completely.

Without Expansion of the Level

For the purpose of calibrating a level scale, adjust the reference line (setting being effected at the respective measuring slide-in chassis) successively to the values to be measured, and superimpose one of the respective level lines on the former. The calibration of the level lines of a level-pattern sender may be carried out in the same manner; for this purpose unscrew the protective cap of the level-pattern sender and with the potentiometers now accessible, carry out the adjustment.

With Expansion of the Level

For the purpose of establishing a level scale or setting lines of tolerance whilst measuring with level expansion, carry out the calibration of the level lines with the aid of the measuring curve. In this connection arrange a suitable attenuator between receive and transmit sections and with it adjust the required level steps. The attenuator may be removed after completion of adjustment. Whenever the expansion ratio is modified, the level lines must be recalibrated.

Level lines not required, to be moved in an upward direction off the CRT display area.

A. Frequency Marker Slide-in Chassis, Type D 928 (Fig. 4)

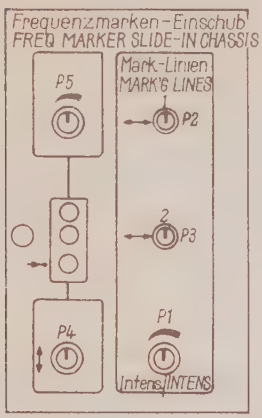


FIG. 4 FREQUENCY MARKER SLIDE-IN CHASSIS

Feed in the frequency marker signals from the transmit section into the input jack of the frequency marker slide-in chassis. Carry out frequency setting and selection of the frequency marker shape (line or envelope curve according to sweep width and rate) in the transmit section (refer to data concerning instructions for use for the transmit section).

The brightness of the frequency marker can be set with P5 and the vertical position of the frequency calibration marker with P4. The horizontal position of the two vertical marker lines can be determined with controls P2 and P3 and their brightness set with P1.

Calibrating the marker lines. Set the frequency marker at the transmit section to the frequency to be marked and let a marker line coincide with the frequency marker by using controls P2 or P3. With a second frequency proceed in precisely the same manner and then insert the frequency marker as a third marking point.

With variations in the mid-frequency or the sweep width, the marker lines must be re-calibrated.

B. IF Amplifier Slide-in Chassis, Type D 916, 1 to 5 kHz (Fig. 5)

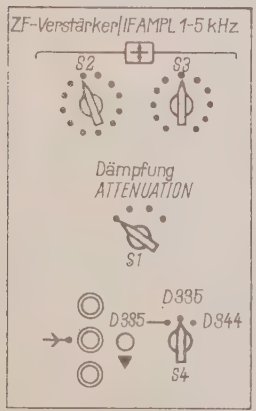


FIG. 5 IF AMPLIFIER SLIDE-IN CHASSIS

This detector amplifier is intended for the connection of level meters, Types D 355 and D 344.

The input sensitivity can be switch-selected for adaptation to the varying output voltages of these two level meters. For measurements with level meter, Type D 344, set switch S4 to "preamplifier on", with the level meter, Type D 335, on "off".

The input sensitivity may furthermore be reduced with the attenuation switch S1 in three steps of 1 dB (0.1 Np) , such as for example with the calibration for absolute level measurements.

For obtaining the measuring result, add the value set at the range switch of the level meter to that read off at the level tracer.

The reference line can be coarsely set in steps of 1 dB with switch S2 and finely in steps of 0.1 (0.01 Np) with switch S3.

C. Wideband Amplifier Slide-in Chassis, Type D 917, 10 kHz to 15 MHz (Fig. 6)

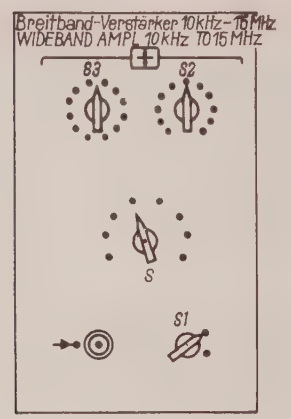


FIG. 6 WIDEBAND AMPLIFIER

Apply this measuring slide-in chassis for wideband measuring with the 15-MHz sweep measuring setup, Type M 701.

The coaxial input with this type of slide-in chassis is always terminated into 75 Ω. Select an input sensitivity between -5 and -40 dB with switch S4 (in steps of 5 dB). For the calibration of the level lines, or for the direct evaluation of the measuring curve, the reference line with this slide-in chassis may be displaced in steps of 1 dB (0.1 Np) and in steps of 0.1 dB (0.01 Np) between -10.5 dB (-1.05 Np) and +1.5 dB (+0.15 Np).

Set the time constant of the rectifier circuit with S1 in relation to the lowest measuring frequency.

D. Wideband Amplifier Slide-in Chassis, Type D 918, 200 Hz to 1.6 MHz

Apply slide-in chassis, Type D 918, for wideband measuring in the carrier frequency range up to 1.6 MHz. Its coaxial input impedance is high; connect termination for the specimen, as necessary, to the parallel jack. With the aid of the measuring range switch adapt the sensitivity (between -60 and +10 dB in steps of 5 dB each) to the level to be measured.

Set switch "f_u" in such a manner that the lowest measuring frequency is situated within the selected range (0.2 to 2 kHz, 2 to 10 kHz, or above 10 kHz).

The buildup of the scale or the evaluation of the screen trace must now be accomplished with the aid of the reference line, which can be set between +1.5 to -10.5 dB.

Balanced measurements may be carried out by connecting level meter, Type D 344 or D 354 in tandem ("wideband" mode).

This slide-in chassis may be left in the equipment for use in conjunction with the selective level meters, Type D 344 or D 354.

E. Wideband Amplifier Slide-in Chassis, Type 919, 30 Hz to 30 kHz

This slide-in chassis is employed for wideband measurements in conjunction with the audio sweep measuring setup, Type M 703, with or without preceding level meter, Type D 342.

Connect the level to be measured to the unbalanced high-impedance input and provide a termination at the parallel jack corresponding to the measuring specimen. For symmetrical measurements use a plug-in type balancing transformer.

Adapt the input sensitivity by means of measuring range switch, which can be set between +20 and -40 dB (+2 and -4.5 Np), in steps of 5 dB (0.5 Np), to the level to be measured.

Set the time constant with switch "f_u" to the lowest frequency to be measured.

Carry out the measuring or setting of a level scale with the reference line (switch for level reference between +1.5 and -10.5 dB (+0.15 to -1.05 Np)).

F. Log. IF Amplifier, Type D 920, 50/100 kHz (Fig. 7)

FIG. 7 LOG. IF AMPLIFIER

The logarithmic IF amplifier is suitable for the logarithmic indication with measuring curves embodying level differences up to 100 dB (10 Np). It has been designed for connection to a level meter with a 50-kHz or 100-kHz output of commensurate high intensity range (e.g. Type D 354).

Set the intermediate frequency either to 50 or 100 kHz, according to the preceding level meter, before sliding-in the chassis.

Feed the IF signal of the level meter into the input jack.

Establish scale with the level reference line.

Select time constant at switch "τ" in such a manner that the measuring curve coincides on the forward and return sweep; in so doing note that transient phenomena of the specimen under test are equally recognized by the divergence of the measuring curve during the forward and return sweeps but must be corrected by reducing the sweep rate.

G. Connecting the Accessories

1. Standard/Unknown Alternate-Presentation Switch, Type B 946

When measuring with the standard/unknown alternate-presentation switch observe the operating instructions contained in its data folder, ref. Rel gesamt 3 B 946. Pick off operating voltages as well as the synchronizing voltage for this switch from jack "⊏⊐" on the right-hand side of the level tracer.

2. Probe

Provision for the power supply of probes has been made, as required, via the jack marked "Probe" (right-hand side of the level tracer), e.g. Type B 938 or B 939. Connect the output of the probe to the input terminals of the respective measuring slide-in chassis.

3. Display Camera, Type B 952

Especially designed for the level tracer, and possessing interchangeable viewing tubes suitable also for other makes of level tracers and oscilloscopes, there is available display camera, Type B 952, for the photography of screen displays. It works on the Polaroid principle and produces a finished paper print in 10 seconds. For further details refer to Instructions for Use, ref. Rel gesamt 3 B 952.

4. Graphic Recorder

A record may not only be made with the display camera but also with a graphic recorder. For this purpose the jack marked "Recorder" has been provided on the left-hand side of the level tracer. Voltage at full-scale deflection at the level tracer: 40 V with an internal resistance of 100 kΩ.

I. GENERAL

There is no need for regular maintenance of the unit, or its continuous supervision and testing.

Should the functioning of the equipment appear to be impaired, check the measuring setup first and investigate whether an error in operation was not made with one of the units connected with the measuring setup. For checking its proper functioning, the test for functioning quoted in Section IV of the part dealing with fault location can be used as a basis.

II. TUBE REPLACEMENT

A further prerequisite for the satisfactory functioning of the equipment are tubes, the data of which correspond to the tube data sheets. Faulty tubes or such which have become worn out in the course of time, can be located with a tube tester and must be replaced by perfect tubes.

With faults showing in the tracing of the measuring curve in conjunction with the IF amplifier slide-in chassis, Type D 916, first test the tubes of this slide-in chassis; all the remaining measuring slide-in chassis are equipped with transistors. With faults appearing in the tracing of the frequency lines, first examine the tubes in the frequency marker slide-in chassis.

When testing the tubes of the basic unit, the equipment insert must be removed from the housing (see Section III).

Should a tube tester not be available, then consider replacing tubes individually which is facilitated by the predominant use of a single tube type (E88CC or CCa). After each replacement, check whether the fault has been eliminated.

III. REMOVING AND INSERTING THE EQUIPMENT INSET

Should the need arise for removing the equipment inset from the housing, position the equipment in such a manner that the front panel points upwards. Then unscrew the polished fixing screws on the front panel. Also slacken the screws on the clamping strips until these permit the release of the front panel. Then place the equipment in the operating position and carefully withdraw the chassis from the housing towards the front.

Exercise great care, since damaging the picture tube will lead to danger from implosion.

Carry out reassembly in reversed sequence; when screwing down the clamping strips, press these over the front panel.

IV. PICTURE TUBE REPLACEMENT

Be particularly careful when replacing the picture tube, since with any damage to the glass there is danger from injury caused by implosion of the picture tube (for this reason only allow trained staff to carry out this work and observe the regulations concerning the working with TV tubes).

First dismantle equipment inset (see Section III), then unscrew frame with protective pane from the front panel. Withdraw plug for anode voltage and deflection unit, and also the socket from the picture tube. Unscrew mount from front panel and place the picture tube with its mount vertically on a soft mat (felt pad), with the screen surface face down. Never carry the picture tube by the neck but,by the rim of the screen surface. Then successively slacken and remove focussing magnets, the shielding tube, the deflection unit, as well as the shielding tube. After slackening the screws of the tensioning strap, the picture tube can be taken from its mount and exchanged. When inserting the new picture tube take care that the anode connection is positioned below the opening in the shielding tube.

V. REPLACING THE INDICATING LAMP

When replacing the indicating lamp, withdraw cover lens and with the aid of the lamp extractor (PVC tubing) supplied in the spare part bag, lift the lamp from its socket pressing lightly and at the same time giving it a slight anticlockwise twist. The replacement lamp, contained in the spare part bag, must then be inserted in the appropriate manner.

F A U L T L O C A T I O N A N D F A U L T E L I M I N A T I O N

I. FAULT LOCATION WITH THE EQUIPMENT SWITCHED OFF

1. Initially check measuring setup. Examine all connecting and interconnecting leads for a tight plug fit and satisfactory condition (e.g. contact resistance for wires of leads and grounded shield).

2. Check main fuse of the equipment.

3. Make a check whether an error in operation has not been made with one of the units in the measuring setup.

4. Remove the chassis from its housing (see maintenance hints, section III). Examine fuse in the high voltage section, Type 35 D 433.

5. Carry out a Visual Inspection

   Overloaded resistors and coils may often be recognized by their discoloration (charred). Before replacing such components, first ascertain the cause of the fault and eliminate it, e.g. examine capacitors, connected in series, for short-circuits.

   Check whether all tubes are firmly seated in their sockets, whether the plug for the deflection unit is tight in its socket and the anode connection of the picture tube has not worked loose.

II. FAULT LOCATION WITH THE EQUIPMENT SWITCHED ON

CAUTION When connecting the exposed chassis to the mains, observe the safety regulations (e.g. in Germany the regulations of the Association of German Electrical Engineers (VDE) regarding electrical workshops). The high voltage for the picture tube is 14 kV; those parts carrying high voltage are shielded by a cover marked with high-voltage warning symbols.

A. General Hints

The main data for fault locating are the circuit diagrams with voltage information in the circuit diagram section. Should the type of fault observed be quoted in the following table of faults, the information found in the table will often reduce the effort in fault location quite substantially.

The instruction "Test forward and reverse resistance" with crystal diodes, signifies a simple measurement with a dc ohmmeter. If the forward and reverse resistances differ considerably, the crystal diode will be in order to a first approximation. A subsequent check measurement of the respective data will naturally supply more accurate information.

All RF voltage (ac) data represent mean values derived from measurements relating to measuring equipment quoted on pp. 4-07 and 4-15 of the section dealing with fault elimination. The accuracy of the measuring values stated, is approximately ±15% unless tolerances differing from these are specified.

The locating of subassemblies, individual components and measuring points is facilitated by referring to the wiring diagrams in the parts list and the circuit data section.

III. FAULT LOCATING TABLE

Type of Fault	Fault Locating
No image	Check power supply unit (Section V.3) Examine high voltage unit (Section V.4)
No horizontal deflection	Test driving voltage from the sweep attachment ($10\ V_{p-p}$). Examine horizontal amplifier (Sec. V.5).
Measuring curve not being traced	Examine measuring slide-in chassis (Sec. VI) Test differentiating amplifier for the measuring curve (Sec. V.6).
No reference line traced	Is there a dc voltage between +10 V and +43 V at the input (R110) of the differentiating amplifier for the reference line? If in the affirmative, examine differentiating amplifier (Sec.V.6), if in the negative, examine voltage divider in the measuring slide-in chassis.
No level lines traced	Examine comparators and differentiating amplifier for the level lines (Sec. V.6).
Frequency markers (frequency line and frequency calibration marker) not being traced	Examine frequency marker signals from the sweep attachment at the input of the frequency marker slide-in chassis. Test supply voltages in the freq.marker slide-in chassis (see Sec. VI.7).
No marker lines present	Examine tubes 1, 2 and 3 of the freq.marker slide-in chassis and the respective circuit (see Sec. VI).
Frequency line (low-pass filter signal) not being traced	Examine tube 4 and the circuit in the frequency marker slide-in chassis (Sec. VI.7).
No frequency marker (high-pass signal) and no level lines	Examine comparator for the freq.calibration marker (Gr7 and C7) and differentiating amplifier for calibration marker and level lines (see Sec. V.6).
Measuring curve, reference line and level lines, frequency lines not available	Examine sawtooth amplifier tubes 2 and 3 and circuit (see Sec. V.5).

Type of Fault	Fault Locating
Calibration unobtainable, calibration voltage abailable	Examine dc amplifier, tubes 9 to 12 and the circuit (Sec. V.7.)
Faulty calibration	Readjust calibration voltage (Sec. IV.2).
Measuring curve or horizontal lines only partially traced and temperature-dependent	Replace diodes Gr17, 25 or 33 in the differentiating amplifier input.
Line graticule bright	Examine adder circuit (tube 15) and grid voltage of CRT (Sec. V.4 and 6).

1. Preparation

Connect the driving voltage and the frequency marker signal from the sweep attachment via connecting leads.
Insert the wideband amplifier.
Connect output of transmit section directly to the input of the wideband amplifier.
Adjust mean sweep width and a level within the measuring range of the wideband amplifier slide-in chassis.

2. Test Calibration Voltage

Connect a level meter, calibrated with a calibration level meter to the jack marked calibration voltage 0 dB (▼III) .
In the case of a selective level meter, tune to maximum at 18.75 kHz ±50 Hz. Set the input of the level meter to a high impedance. Measure calibration voltage: nominal value 0 dB ±0.05 dB. (With greater deviations readjust the maximum with the aid of the balancing screw of Ü3 in the high-voltage section, 35 D 433, and align for 0 dB with R37.)

Switch the level meter input to 75 Ω and test calibration voltage -40 dB(▼II).

3. Calibrating

Carry out calibration (see Instructions for Use, p. 2-04).
With Calibration I (▼I), the measuring curve is made to coincide with level line -∞ with an open input of the wideband amplifier slide-in chassis. The level line -∞ is traced even when the level lines have been switched off and should be situated approx. 1 cm from the lower edge of the CRT screen; with a different position, readjust with the aid of R40 in the sawtooth amplifier, Type 35 D 436. Should ▼I prove impracticable, test both the dc amplifier, Type 35 D 434, and the voltage at P9 (see Sec. V.7). If calibration II or III cannot be carried out satisfactorily, then test the dc amplifier, Type 35 D 434 (see Sec. V.7).

4. Check on the Controls

Brightness control:
Measuring curve brightens when turning control (P14) clockwise.
Reference line brightens when turning control (P16) clockwise.
Level lines brighten when turning control (P15) clockwise.
(For adjusting basic brightness, see "Adjusting the CRT Voltages", Sec.V.4).

Control for expansion and position:

The variation in deflection (vertical) - e.g. up to 0.1 dB, performed at the level oscillator - should permit up to a tenfold expansion when turning control P10 in a clockwise direction (failing this, test dc amplifier, Type 35 D 434, Sec. V.7).

At the same time check the displacement with control (P8) "position"; turning in a clockwise direction should produce an upward movement (failing this: test displacement voltage at P8 and dc voltage in the dc amplifier, Type 35 D 434, Sec. V.7).

Test expansion of the frequency band (horizontal); by the turning of control P7 clockwise, up to approximately ten times the amount. A check is obtained by measuring out the frequency band with a frequency marker. In this connection a displacement with the aid of control P6 "position" is practicable, clockwise rotation of the control resulting in a displacement to the right, (failing this, check horizontal amplifier, Type 35 D 436, Sec. V.5).

5. Frequency Marker Slide-in Chassis

With control P5 marked "Brightness" test the brightness control of the frequency markers (frequency line, frequency calibration marker). With the aid of control P4 check the displacement of the frequency calibration marker over the full display height. Check the displacement of the marker lines across the entire display width with controls P2 and P3 and with control P1 marked "Brightness", the brightness control. (In case of faults, test frequency marker slide-in chassis, see Sec. VI.7.)

6. Measuring Slide-in Chassis

For the purpose of checking the wideband and IF amplifier slide-in chassis, apply a level corresponding to the measuring range via an attenuator.

The steps of the reference line can be checked in that the measuring curve is displaced by respective attenuation steps and that the reference line should then coincide with the measuring curve.

In order to check the frequency response within the respective frequency range, apply whenever possible an automatically controlled transmitting voltage to the slide-in chassis, since the stated tolerance for the frequency response of the indication (see Electrical Data, 1-04) is added onto the tolerance of the frequency response of the transmit-section voltage.

For the purpose of testing the various adjustable time constants of the rectifier circuit, sweep periodically down to the lowest frequency set. The ripple content of the rectified voltage may, at this frequency, make up 1% of the

level. The measuring curve on the CRT screen may, therefore, increase in width up to 1% of the level applied (adjust vertical expansion).

V. FAULT ELIMINATION AND REALIGNMENT OF THE BASIC EQUIPMENT

1. Measuring Instruments Required

Level oscillator
Sweep attachment
} of the respective sweep measuring setup.

Cathode-ray oscilloscope, e.g. "Oscillar", Type I/G60
Variable-voltage unit for setting the exact mains input voltage
Siemens "Multizet" microammeter
Siemens "Multizet" millivoltmeter
Siemens "Multizet", combined A-V-Ω meter

As required: frequency counter for realigning the scanning-line frequency.

2. General Hints

Connect the equipment via the variable-voltage unit to the mains voltage and adjust to the nominal mains voltage.

Do not commence with measuring until the operating temperature has been reached some 30 minutes after switching on the equipment.

The voltage data quoted in the circuit diagrams and in these Instructions for Use are mean values; unless specific tolerances have been quoted, the tolerance may be ±15%. If the hints given in the Fault Locating Table (Sec. III) are observed, the faults will generally be located more rapidly.

When replacing faulty components, whenever possible, do not disturb the position of the wiring. Unless unsoldered wires are clearly distinguishable by their colors, these should for example be marked with cemented-on paper tags. Make fresh solder points with care.

When replacing semiconductors (e.g. crystal diodes) exercise particular care to avoid causing cracks in the lead-in, frequently consisting of glass; bend wires over an edge, e.g. with flat-nosed pliers.

Semiconductors, but also small carbon-film resistors and styroflex capacitors are sensitive to temperature. Therefore do not shorten terminal wires of semiconductors. When soldering, provide for good heat dissipation, such as for example by the use of a pair of flat-nosed pliers with copper jaws.

3. Power Supply Unit Type 35 D 437

The power supply unit is functionally correlated with the high-voltage unit, Type 35 D 433. Therefore, with faults occurring in the power supply unit or the high-voltage unit, include the other subassembly in the examination.

DC Voltages and Re-alignment:

Measuring point	Nominal value	Remarks
Solder pin Ca12	±250 V ±2.5 V	Voltage can be readjusted with R10 in the high-voltage section (modification of the setting voltage derived from the high-voltage section for regulating tube T21). With the absence or fluctuation of the voltage, check stabilizer tube 1 85 A2, high-voltage section 35 D 433 and tube 21 with its circuit.
Solder pin Cb11	±60 V ±1 V	can be readjusted with R7. Fault locating as for voltage at solder pin Ca12.
Solder pin Cb7	-11.2 to -12.4 V	voltage for the brightness controls P14 to P16 from the horiz.amplifier 35 D 436 (Ts4). Fault locating: check voltage at solder pin Ca6 -22 V, Ts4 and circuit in 35 D 436.
Solder pin Ca5	-250 V ±5 V	voltage can be readjusted with R10 in the high-voltage section (check voltage at Ca12). Fault locating: as for Ca12 and circuit for tube 23.

All remaining voltages of the mains unit to be tested in accordance with data quoted in circuit diagram Rel str 3 D 346.

4. High-Voltage Unit, Type 35 D 433

Check multivibrator tube 4 (E88CC) and the circuit, measure anode voltages in accordance with data given in circuit diagram, Rel str 3 D 346c1a.

Connect oscilloscope to grid of tube 6; a square-wave voltage of approx. 80 V_{p-p} with a unity on/off pulse ratio, period duration approx. 53 µs (f = 18.75 kHz ±50 Hz) must be reproduced. Should a deviation in the frequency be suspected, check the latter with a frequency counter and realign, as necessary, by varying the capacitance C2.

The value of this square-wave voltage across the cathode resistor of tube 6 (E236 L) should be approx. 0.2 V_{p-p}. Should this voltage not be available, test

fuse Si1 and the anode voltage (booster diode T7 PY81). Also check the control dc voltage (-6.7 V) applied to the grid of tube 6 (E 236 L) via diode Gr1; should this voltage be incorrect, then check tube 5 (E88CC) and remeasure the regulated voltage (A7, -85 V) applied to the grid. This voltage from the power supply unit, however, is dependent on the grid voltage for tube 23 in the power supply unit, derived from the high-voltage unit (possibly apply an external voltage, such as from an anode battery). At the output leading to the sawtooth amplifier (A5/A6 ⊥) there should be a sawtooth voltage of approx. 80 V_{p-p} (18.75 kHz ±50 Hz) and at the output of Ü3 (r/r' ⊥) calibration voltage (sine voltage) of 0 dB (readjustment with R37, as required). In the absence of the anode voltage for the CRT (dark image), test the rectifying tube (T8, EY86). Since the high voltage is between 12 and 14 kV, exercise particular care.

Potentiometer R25 is used for readjusting the image brightness; with the aid of R18 and the correcting magnet on the CRT, focussing can be readjusted.

5. Sawtooth and Horizontal Amplifiers, Type 35 D 436

Horizontal amplifier:
With the input short-circuited, examine "Hor.Deflection" and readjust as necessary:
Checking of the heating voltage for tube 1 (E88CC at the solder pin strip Ea7 (neg) to chassis (pos) -6.3 V (tolerance -0.2 V) readjustable with R59 in the control circuit (Ts7, 8 and 9). The reference voltage derived from the 20-kHz sawtooth voltage for the control of the constant sum-current of transistors Ts3 and TS5 must be 4.4 V ±0.1 V at C6 (measure with Siemens "Multizet" microammeter). If all the circuit components are in working order, this voltage may be realigned by resoldering the taps of Ü2 in conjunction with a parallel resistor R25.

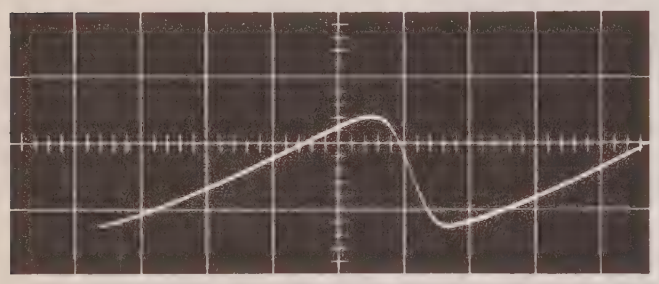
The dc voltage for the horizontal displacement, equally derived from the 20-kHz sawtooth voltage wave via Ü1 and diodes Gr1 and 2, should be adjustable between -13 and +9 V between the wiper of potentiometer P6 and the connecting points R2, R3 (measure with Siemens"Multizet" set to the 30-V range).

Should, after repairs, a considerable picture shift occur during expanding, realign the horizontal amplifier as follows:
Disconnect the lead to the deflecting coil at R23/24 and connect an ammeter in the circuit (e.g. Siemens "Multizet" millivoltmeter).

Set potentiometer P7 marked "Exp.hor." to left-hand stop and with potentiometer P6 "Pos.hor." adjust current to deflection coil to read zero. Then set potentiometer P7 to the right-hand stop and adjust the potentiometer R29 in such a manner that as small as possible a variation in current occurs when

varying P7 over the entire range. In view of the fact that a variation of R29 influences the setting of P6 "Pos.hor.", realign both these potentiometers alternately. Current variation with the turning of P7 should not exceed 50 mA after realignment and not deviate by more than ±10 mA from zero at the right-hand and left-hand stops.

Sawtooth Amplifier:
An 80 V_{p-p} sawtooth should be found at the output of the sawtooth amplifier (cathode T3). Utilize the dc input of an oscilloscope for measuring this voltage, since approximately 70 V_{p-p} of the sawtooth should be situated in the positive and approx. 10 V_{p-p} in the negative region (see oscillogram).



SETTING ON THE OSCILLOSCOPE
Y = 50 V/cm X = 10 µsec/cm

Its position can be corrected with potentiometer R40. With deviations in amplitude, frequency or the waveform from the nominal value, check the input voltage and sawtooth frequency in accordance with the data quoted in the high voltage section (Sec.V.4), and if in working order, examine the amplifier, such as for example by measuring dc voltages at the tubes according to the data quoted in the circuit diagram.

6. Differentiating Amplifier, Type 35 D 435

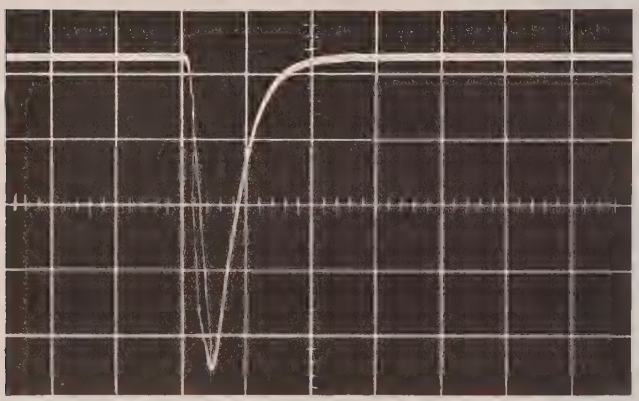
Channel reference line (T19, 20):
Should the reference line not be traced or be inadequately traced, connect chassis to the input lead-through pin.

With the aid of P16 "Brightness Reference Line" set +3 V at soldering lug Da2 (measure with a Siemens "Multizet" microammeter). Set potentiometers P14 and 1 "Brightness Measuring Curve" and "Brightness Level Lines" fully to the left-hand stop (dark), thus causing the other difference amplifiers to become blocked.

Connect the oscilloscope with the probe to tube 15, anode, pin 6.
(CAUTION: approx. 200 V dc potential!)
The oscillogram should exhibit negative pulses (amplitude ≧ 35 V_{p-p}, width

at half-amplitude points approx. 0.2 µs), the unweighted noise voltage should be less than 1 V_{p-p}.

If negative pulses are present, then the channel of the reference line is in working order; should they not be present, continue testing as under: at the grid of tube 20, pin 7, there should be negative pulses of approx. 40 V_{p-p}, at the grid of tube 20, pin 2, positive pulses of approx. 10 V_{p-p}, at the grid of tube 19, pin 7, negative pulses of approx. 0.8 V_{p-p}, and at the grid of tube 19, pin 2, a square-wave voltage with a rising edge of approx. 0.15 V_{p-p} (see oscillograms). Those circuit sections thus are located, in which one must continue locating the fault by following the circuit diagram.



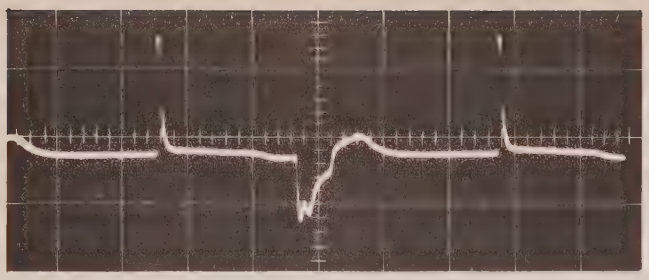
OSCILLOSCOPE CONNECTED TO T15, ANODE PIN 6
Y = 10 V/cm X = 0,2 µsec/cm

After the completion of repairs check and readjust if required: set voltage at wiper of potentiometer R131 to -9 V (Siemens "Multizet" microammeter, 30-V range).

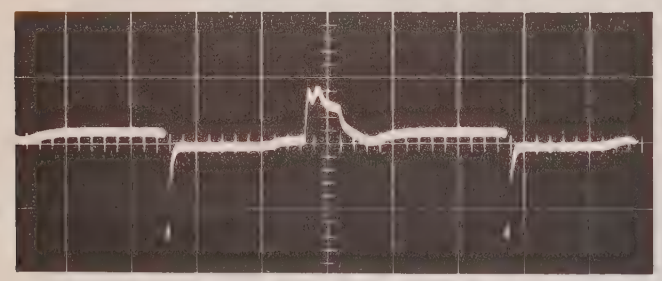
Set voltage at wiper of potentiometer (in the measuring curve channel) to -8.5 V (Siemens "Multizet" 30-V range).

Measuring Curve Channel (T13, 14, 15):
With a non-existent or faulty image of the measuring curve:
Setting: disconnect dc amplifier from the differentiating amplifier (lead-through solder pin "e") and connect point "e" to chassis. Move potentiometers P15 and 16 "Intensity Level Lines" and "Brightness Reference Line" to their left-hand stops, so that the other differentiating amplifiers are blocked. With the aid of P14 "Brightness Measuring Curve" set zero volts (measure with Siemens "Multizet" microammeter) at soldering lug Da4.

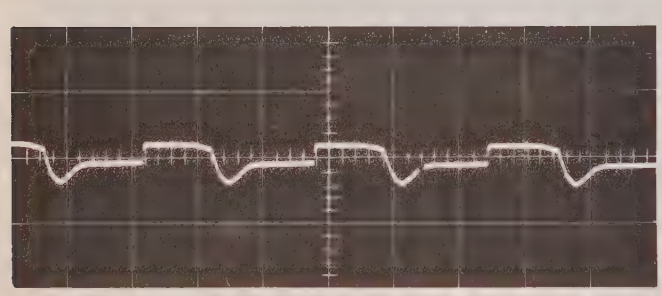
Connect oscilloscope with probe to anode pin 6 of tube 15. The oscillogram should consist of negative pulses (amplitude >35 V, width at half-amplitude points, approx. 0.2 us), the noise voltage to be smaller than



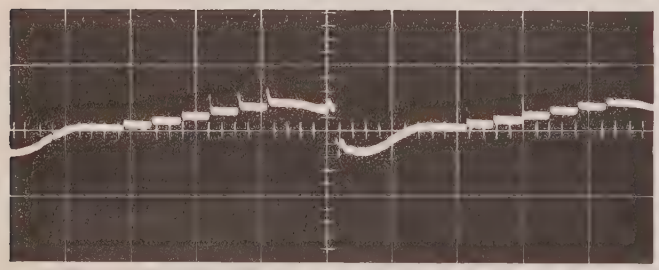
OSC. CONN. TO T20, GRID PIN 2 (T14, GRID PIN 2)
Y = 5 V/cm X = 10 μsec/cm



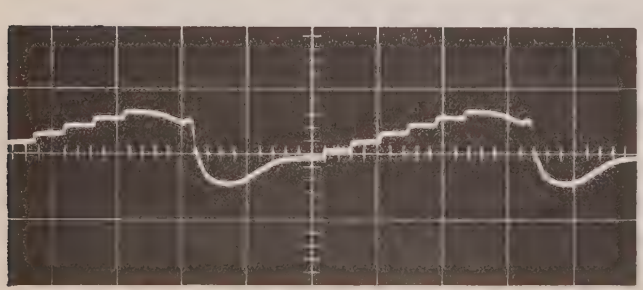
OSC. CONN. TO T19, GRID PIN 7 (T13, GRID PIN 7),
Y = 0.5 V/cm X = 10 μsec/cm



OSC. CONN. TO T19, GRID PIN 2 (T13, GRID PIN 2)
X = 0.5 V/cm X = 20 μsec/cm



OSC. CONN. TO T17, GRID PIN 2
Y = 0.5 V/cm X = 10 μsec/cm



OSC. CONN. TO T16, GRID PIN 2
Y = 0.5 V/cm X = 10 μsec/cm

1 V. Should this display obtain, locate fault in the dc amplifier, if not then record further oscillograms for localizing the fault at the grids of tubes 13 and 14 similar to the method for the corresponding tubes of the reference line channel.

Check the following after completion of repairs and adjust as necessary:
Voltage at the wiper of potentiometer R43 to be -8.5 V (measure with Siemens "Multizet" microammeter, 30-V range).

Channel level lines (T16, 17, 18):
With a non-existent or faulty image of the level lines:
Set switch S2 for the level lines to "Level Lines On" (right-hand stop).
Move potentiometers P14 and P16 (brightness measuring curve and reference line) to the left-hand stop.

Adjust potentiometer P15 (brightness level lines) in such a manner that there are +3 V to chassis at solder tag Db2.
Connect oscilloscope with probe to anode pin 6 of tube 15.

During one cycle (approc.50 μs) the oscillogram should register a group of six negative pulses with an amplitude = 30 V_{p-p} and a respective width at the half-amplitude points of 0.2 μs.

Distribute the pulses uniformly with potentiometers P1 to P5 (Level Lines Displacement).

Unweighted noise voltage to be $\leq$ 1 V.

Additional signals in the level line channel for localizing the faulty circuit section:

Tube 18, grid pin 7: negative pulses of approx. 40 V_{p-p}

Tube 18, grid pin 2: positive pulses of approx. 10 V_{p-p}

Tube 17, grid pin 7: negative pulses of approx.1.5 V_{p-p}

Tube 17, grid pin 2: rising staircase wave, height of step approx.0.05 V_{p-p}

Tube 16, grid pin 2: rising staircase wave, height of step approx.0.05 V_{p-p}
(see oscillogram, p.4-12).

After completion of repairs check, and readjust as necessary:
Voltage at wiper of potentiometer R101: -6 V (measure with Siemens "Multizet" microammeter, 30-V range).

The regulating equipment accommodated in the subassembly containing the differentiating amplifier for the stabilized voltages A12, A13 and A14 must be tested and readjusted after fault eliminating as follows:

a. Voltage A12: -24 V measure between solder tag Da7 and chassis (Siemens "Multizet" microammeter) and readjust with R151 to read -24 V.

Measure ripple voltage, for example, with an oscilloscope and with R147 reduce to a minimum.

Repeat alignment for voltage and hum voltage minimization until the minimum hum voltage and the exact voltage have been set.

b. Voltage A13: +24 V to be measured at soldering lug Db5, readjusting the voltage with R165, the minimization of the hum voltage with R162 to be carried out as under item 1.

c. Measure voltage A14: +20 V with probe connected (supply voltage) at soldering lug Da5,
readjust voltage with R168.

7. DC Amplifier, Type 35 D 434

For measuring the voltages stated in the circuit diagram, set switch S1 to position ▼, potentiometer P8 "position vertical" to the right-hand stop.

After tube replacement or repairs, measure the following voltages and readjust as necessary:

Remove slide-in chassis. At the positive and negative (R1 and R2) input of the dc amplifier solder one each 1-kΩ resistor to the wiper of potentiometer R8 and connect wiper via a 1-µF capacitor to chassis.

Disconnect lead e (output) to the subassembly containing the differentiating amplifier.

a. Connect grid of tube 12 at junction C6/C7 and chassis. Measure voltage between pin 8 of cathode and chassis with a Siemens "Multizet" microammeter (300-V range); readjust with R32 to +150 V, as required.

b. Connect anodes (1 and 6) of tube 11 to chassis.
Connect anode (6) of tube 9 and anode (1) of tube 10.
Measure voltage between anode (6) of tube 9 and chassis with a Siemens "Multizet" microammeter; adjust -90 V with R8.

c. Link anodes (1 and 6) of tube 11 (do not connect to chassis) and interconnect anode (6) of tube 9 to anode (1) of tube 10. Measure between output (point e) and chassis with a Siemens "Multizet" microammeter; readjust to 0 V with R22, as required.

d. Cut connections again, move control P10 "Expansion vertical" as far as the right-hand end stop.
Again readjust to 0 V at the output (point e) with R16.

Move P10 to its left-hand end stop and then readjust to 0 V with R13.

Repeat balancing with right-hand and left-hand adjustment of P10 until the voltage difference between the two adjustments is $\leq$ 0.1 V.

After completion of measurements, remove measuring circuits and re-establish the connection to the differentiating amplifier.

VI. FAULT ELIMINATION AND REALIGNMENT OF SLIDE-IN CHASSIS

1. Measuring Equipment Required

Sweep measuring setup, relevant to the slide-in chassis
Level oscillator, e.g. Type W38
Wideband voltmeter, e.g. Type U133
Tube or digital voltmeter for dc measurements
Attenuator, e.g. Types D110, D117, D120
Cathode-ray oscilloscope, e.g. "Oscillar", Type I/G60
Siemens "Multizet" microammeter
Siemens "Multizet" millivoltmeter
Siemens "Multizet" for RF measurements
Testing cables, Rel Bv 657 C 3006

2. IF Amplifier Slide-in Chassis, Type D916

a. General

Connect slide-in chassis via the test lead, Bv 657 C 3006 to the level tracer (left-hand slide-in chassis compartment).

Test the tubes and ascertain whether the fault can be eliminated by tube replacements. Carry out visual inspection (soldered joints, broken wires, short circuits).

For the purpose of fault localization, check the voltage values entered in the circuit diagram, Rel str 3 D 916, with a Siemens "Multizet" microammeter.

b. Checking Gain and Frequency Response

Turn attenuator switch S1 to 0 dB (0 Np), switch S4 to position 2 (D335). With the level oscillator (W38) apply a voltage of 8.5 V rms (+20.5 dB; +2.4 Np), f = 3 kHz, Zi = 0 Ω to the input of the slide-in chassis.

Measure voltage with wideband voltmeter between cathode T2 and chassis; nominal voltage: 7.8 to 8.2 V rms.

Measure dc voltage with Siemens "Multizet" microammeter at R24 and R25; Nominal value: 5.7 to 6.3 V

Should the voltages deviate from the nominal values, then search for the cause of the fault in the circuit of tube 2 or in the rectifier circuit.

For the purpose of measuring the frequency response with a constant transmitting voltage, vary the frequency between 1 and 5 kHz; the voltage indicated at the "Multizet" microammeter must not deviate, by more than ±0.2 V from the value measured at 2.5 kHz.

Reduce transmitting level (f = 3 kHz) to 0.775 V (0 dB, 0 Np) and turn switch S4 to position 3 (D344).

The ac voltage should then be between 7.7 and 8.3 V rms and the dc voltage between 5.6 and 6.4 V.

Should these voltages be outside these limits, examine circuit connections of tube 1.

For measuring the frequency response, keep the transmitting voltage constant and vary the frequency between 1 and 5 kHz; the voltage indicated on the "Multizet" microammeter must not deviate by more than ±0.2 V from the value measured at 2.5 kHz.

3. Wideband Amplifier Slide-in Chassis, Type D917

a. General

Connect wideband amplifier via test lead, Rel Bv 657 C 3006 to the level tracer (left-hand slide-in chassis compartment).

Carry out visual inspection (cold soldered joints, broken wires, short circuits).

Check the voltage values entered in the circuit diagram, Rel str 3 D 917, with a "Multizet" microammeter.

b. Adjusting the working Points

After completion of repairs, check the following working points and readjust as necessary:

Turn measuring range switch S4 to left-hand stop (-5 dB, -1 Np).
Measure between emitter TS3 and chassis with "Multizet" microammeter and with R2 adjust to -8.9 V.

Measure between emitter TS6 and chassis with "Multizet" microammeter and with R13 adjust to -8.9 V.

c. Checking the Gain

Connect "Multizet" microammeter to the output (adapter plug-strip, pin 7(+) and pin 10 (-); select the 20-µA range. Turn switch S4 (measuring range) of the slide-in chassis to -40 dB (-30 dBm, -4.5 Np). Connect "Multizet" instrument for RF measurements to the emitter of transistor TS6.

Set level oscillator, for example Type W518, to f = 500 kHz, Zi = 75 Ω, oscillator level to -40 dB (-4.5 Np) and connect it to the amplifier input. Readjust the transmitting level until the RF voltage measured is 2.35 V. The reading on the "Multizet" microammeter should then be 72.5 ±4 scale divisions and the level set at the level oscillator -38.5 dB ±0.8 dB

(-4.43 Np ±0.09 Np) and with equipment designed for dBm it should be -37.5 ±0.8 dB.

A voltage of 1.65 V should be measured with the "Multizet" for RF measurements at the ac output (plug strip, pin 2) and chassis.

d. Readjusting the Frequency Response

Insert wideband amplifier into the basic equipment and allow to warm up for not less than half an hour.

Keep the output voltage of the sweep frequency generator constant via probe, Type B 939, and connect via an attenuator (e.g. D120) to the slide-in chassis.

Setting the sweep-frequency attachment: mid-frequency 8 MHz, sweep width 17 MHz, sweep rate approx. 5 Hz.

Setting the level oscillator: Zi = 0 Ω, transmitting level 0 dB (0 Np).
Set the attenuator for 40 dB (4.5 Np).
Select maximum vertical expansion at the level tracer and with the attenuator calibrate two level lines 0.1 dB (0.01 Np) apart.

By fine adjusting the transmitting level, place the metering curve at 2 MHz centrally between the two level lines.

Realign the frequency response of the slide-in chassis in such a manner with C6 and C13, that the displayed curve extends between the two limit lines, then briefly remove the slide-in chassis from the basic equipment and slightly vary the trimmer setting each time (observe direction of rotation) until the frequency response required has been obtained. The two trimming capacitors should be set approximately to the same value.

4. Wideband Amplifier Slide-in Chassis, Type D918

a. General

Connect wideband amplifier via the test lead, Rel Bv 657 C 3006, to the level tracer (left-hand slide-in compartment).

Carry out visual inspection (cold soldered joints, broken wires, short circuits). Check the voltage values entered in the circuit diagram with a "Multizet" microammeter (for the model in Neper, Rel str 3 D 918a1a, for the model in decibel, Rel str 3 D 918a2a).

b. Readjusting the Working Points

After completion of repairs, check the working points mentioned below and readjust as necessary:
Measure between emitter of transistor TS9 and chassis, and adjust to +12 V with R28.

Measure between emitter of transistor Ts4 and chassis, and adjust to +12 V with R8.

c. Fault Location and Modulation Check with an Oscilloscope

Connect level oscillator to the input and feed in with Zi = 0 Ω, f = 100 kHz, a signal of p = +14.5 dB (+1.67 Np).

Set at the slide-in chassis: level p = +10 dB, lower cutoff frequency f_u = 0.2 kHz.

The voltage at the emitter of transistor Ts2 of input stage 35 D 716 should be approx. 11.6 V_{p-p} and sinusoidal.

The voltage with the slide-in chassis in decibels should be approx. 7.8 V_{p-p} at the emitter Ts4 of the amplifier and with the slide-in chassis in Neper approx. 14.3 V_{p-p} and sinusoidal (readjust as required with R8).

The voltage at emitter Ts9 should be approx. 16.4 V_{p-p} (decibel model), 17.4 V_{p-p} (Neper model) and sinusoidal (readjust working point with R28 as required).

d. Checking the Gain

Set level oscillator to Zi ≈ 0 Ω, p = 0 dB or 0 Np, f = 1 kHz; set slide-in chassis to p = 0 dB (0 Np), f_u = 0.2 kHz.

At the output contacts 7 (pos.) and contact 10 (neg.) the following voltages should appear: with the decibel slide-in chassis 4.62 to 4.92 V and with the neper slide-in chassis 4.73 to 5.03 V (measure with an ungrounded digital or tube voltmeter). A readjustment may be made with a resistor connected in parallel with R33.

e. Checking the Frequency Response

For the purpose of checking the frequency response, calibrate level tracer (see Instructions for Use, p. 2-04) and establish a level tolerance scale with greatest possible vertical expansion with 0.1-dB (0.01-Np) spacings between level lines (see Instructions for Use, p.2-05)

Connect sweep generator (output level 0 dB, 0 Np) to the slide-in chassis (p = 0 dB, 0 Np; f_u = 0.2 kHz) and sweep periodically between 10 kHz and 1.6 MHz and between 0.2 kHz and 10 kHz.

Frequency response between 10 kHz and 1.6 MHz ±0.05 dB (±0.005 Np); realignment may be made with C6 and C26.

Frequency response between 0.2 and 10 kHz; preemphasis < 0.05 dB (0.005 Np) in the range up to 10 kHz, deemphasis at 200 kHz < 0.1 dB (0.01 Np).

5. Wideband Amplifier Slide-in Chassis, Type D919

a. General

Connect amplifier slide-in chassis via test lead, Rel Bv 657 C 3006 to the level tracer (left-hand slide-in compartment).

Carry out visual inspection (check for dry joints, wire breaks, short circuits)

Check with a "Multizet" microammeter the voltage values entered in circuit diagram, Rel str 3 D 919a2a (decibel) and Rel str 3 D 919a1a (neper).

b. Aligning the Working Points

After completion of repairs, check the following working points and realign as necessary:

Measure between emitter of transistor Ts6 and chassis with a "Multizet" microammeter in subassembly 35 D 722 and realign with the aid of R24 to +8.6 V (increase value of R27 to 4.7 kΩ, as necessary).

In subassembly 35 D 723 measure between emitter Ts5 and chassis and realign with the aid of R10 to +12.6 V (if necessary, reduce R15 to 3.3 kΩ). Apart from the voltages entered in the circuit diagram, the voltages should read as under, at the following points:

In subassembly, 35 D 722 voltage at C3: 1.92 to 2.88 V ("Multizet" microammeter, 10-V range).

In subassembly, 35 D 723 voltage at R22: 4.86 to 5.94 V ("Multizet" microammeter, 10-V range).

Working points of the rectifier circuit:
For the purpose of testing the rectifier circuit, repeat voltage measurements with a tube or digital voltmeter of high impedance

at Gr6: 12.83 to 14.7 V
at R41: 12.0 to 18.8 V
between collector Ts13 and emitter Ts13: 18.9 to 23.1 V
between collector Ts12 and emitter Ts12: 1.17 to 1.43 V
between collector Ts11 and emitter Ts11: 18 to 22 V.

c. Fault Location and Modulation Control with an Oscilloscope

Connect level oscillator (e.g. Type W38) to the input and adjust to Zi = 0 Ω, p = +14 dB (+1.0 Np), f = 800 Hz.

Set at the slide-in chassis: level switch S1 to +10 dB (+0.5 Np), switch S4 "Time Constant" to f_u = 30 Hz.

Connect oscilloscope to emitter Ts5 in subassembly 35 D 723. The voltage displayed should be 11 V_{p-p} and free from distortion (slightly readjust transmitting voltage as necessary. Should limiting phenomena occur, readjust the work-

ing point with the aid of control R10. Should this not prove feasible, or the signal be non-existent connect oscilloscope to emitter Ts6 in subassembly 35 D 722. Set level switch S1 to +5 dB (0 Np), realign transmitting level in such a manner (approx. +11 dB/+0.7 Np) that the voltage indicated is 11 V_{p-p}. The voltage indicated should be free from harmonics (readjust working point with R24 as necessary).

If a fault could not be localized up to this stage, then check the input stage:
Connect oscilloscope to emitter of transistor Ts2 in subassembly 35 D 722. Move level switch to position +20 dB (+2 Np).

Set transmitting level to +22 dB (+2.5 Np).

The voltage indicated should be approx. 27.5 V_{p-p} and free from harmonics.

d. Realigning the Gain

Set at the level oscillator (e.g. Type W38): p = 0 dB (0 Np), f = 800 Hz, Zi = 0 Ω (whenever practicable, test oscillator level with a calibration level meter).
Adjust at the slide-in chassis: level switch to 0 dB (0 Np), f_u = 30 Hz. With the aid of a high-impedance tube or digital voltmeter measure at the output for subassembly 35 D 725 between pin 22 and pin 23.

Nominal voltage at slide-in chassis with dB-calibration: 4.773 to 6.067 V; nominal voltage at slide-in chassis with neper calibration: 4.879 to 5.181 V.

The voltage can be readjusted by varying controls R26 in 35 D 722 and R14 in 35 D 723; their resistances should be about equal (±20%).

e. Realigning the Rectifier Circuit

After carrying out repairs in the rectifier circuit, realign for minimum ripple content:

Apply to the input of the slide-in chassis a voltage of p = 0 dB (0 Np), f = 30 Hz and Zi = 0 Ω.

Set level switch at amplifier slide-in chassis to 0 dB (0 Np) and f_u = 30 Hz

Connect the horizontal deflecting voltage from the sweep frequency attachment to the level tracer, adjust sweep frequency to approx. 2 Hz.

Adjust maximum expansion on the level tracer and shift the measuring curve with control "Position Vertical" into center of the screen. A sinusoidal curve with an approximate height of 50 mm will be traced out. Successive pulses should have equal amplitudes (readjust with R34 in 35 D 723).

f. Check Frequency Response

Calibrate level tracer for -∞ (see Instructions for Use, p.2-04) and establish a tolerance scale with a 0.1-dB (0.01-Np) spacing with maximum vertical expansion (see Instructions for Use, p.2-05). Adjust a 20-Hz horizontal deflection at the sweep attachment. Insert the slide-in chassis in the level tracer, set 0 dB (0 Np) and f_u = 30 Hz at the level switch. Connect output of level oscillator (e.g. level oscillator W38) to amplifier input. Whenever possible, connect a calibration level meter to the parallel jack of the slide-in chassis.

Keep the level oscillator at a stable p = 0 dB (0 Np) and ascertain with the aid of the level scale the deviation of the measuring curve at the following specific frequencies, related to the value at 800 Hz:

f = 30 Hz, 40 Hz, 50 Hz, 70 Hz, 100 Hz, 800 Hz, 10 kHz, 25 kHz, 30 kHz.
Frequency response to be below ±0.07 dB (±0.008 Np).
If required, the frequency response can be readjusted at low frequencies with control R12 in 35 D 723.

6. Logarithmic IF Amplifier Slide-in Chassis, Type D920

a. Checking the amplifier in its entirety

Connect amplifier via the test lead to the level tracer (left-hand slide-in compartment).
Connect level oscillator, e.g. Type W38, via an attenuator (D110) to the input jack and set level oscillator to p = 0 dB (0 Np), f = 100 kHz. Attenuator to 0 dB (0 Np). Set filter of the IF amplifier slide-in chassis to 100 kHz. Set reference line to 0 dB (0 Np) and make the measuring curve coincide with the reference line by means of control "Correction Calibrate II, III" (P11).

Should the measuring curve be situated at a considerably lower level, one of the ten amplifier stages has probably become unserviceable. Proceed to readjust the reference line until it approximately coincides with the measuring curve. From the value adjusted for the reference line, the faulty amplifier can be detected. If one subtracts the number X from the number 11 to which the reference line switch had been set (at dB X x 10^{-1}), one obtains, in this manner, the serial number of the amplifier (see circuit diagram). Should measuring curve and reference line 0 dB (0 Np) coincide, then check the amplifier slide-in chassis by a stepwise attenuation by 10 dB (1 Np) at time and simultaneous realignment of the reference line.

After the completion of repairs, measure the output DC voltage at the input level of 0 dB (0 Np) with a high-impedance tube or digital voltmeter between contact F10 (neg.) and F7 (pos.) and F6 (0 V) of 2.93 V, respectively, (volt-

age between F7 and F10 5.85 V); as necessary readjust with R29 and R30.

b. Amplifier Stages 1 to 10, 35 D 590a2a, 2b

Measure supply voltage at all amplifier stages with a "Multizet" microammeter: -12 V (see circuit diagram, Rel str 3 D 920).

Withdraw panel containing the unserviceable amplifier stage, two amplifier stages being combined on one panel each.

Apply supply voltage of -12 V (I = 15 $\pm$ 0.5 mA) between pins 8 and 11 and chassis pin 2.

Measure the dc voltages entered in the circuit diagram for fault locating with a "Multizet" microammeter.

After the completion of repairs, the gain at 50 and 100 kHz has to be measured as under and readjusted:

Terminate output (pin 1) by connecting a series network consisting of a capacitor C = 4000 pF and a resistor R = 2 kΩ to chassis (pin 2).

Apply to the input of the first amplifier stage (between pins 13 and 12) (grounded) a signal of p = -20 dB (-2.3 Np), f = 50 kHz.

Connect the level meter to the output of the first amplifier stage (between pins 10 and 12) via a short balanced cable (e.g. Rel ltg 703a) and measure.

Nominal level: -9.95 to -10.25 dB (-1.145 to -1.18 Np)

Apply to input a signal of p = -20 dB (-2.3 Np), f = 100 kHz and with C2 realign to the same output level as for f = 50 kHz. Repeat both measurements until the same output level has been obtained.

Reduce the input level to -29.8 dB (-3.43 Np) and set f = 50 kHz.

Measure level at the output of the second amplifier stage (between pin 1 and pin 2 of chassis).

Nominal level: -9.75 to -10.25 dB (-1.12 to -1.18 Np),

input frequency to be set at the same level to 100 kHz and to be realigned with C12 to the same level as for 50 kHz. Repeat both measurements until the same output level has been obtained.

Testing the dc voltage output:

Set input level to -12 dB (-1.38 Np), f = 50 kHz.

Measure between pins 4 (pos.) and 7 (neg.) with tube or digital voltmeter, nominal voltage 375 to 415 mV.

At 100 kHz the dc voltage should be equal to that at 50 kHz. Tolerance: -6 mV.

Adjust input level to 0 dB (0 Np), f = 50 kHz.

The dc voltage at the output (pins 4/7) should be 0.9 to 1.18 V.

Set input level to -21.8 dB (-2.51 Np), f = 50 kHz.

Measure between pins 3 (pos.) and 6 (neg.) with a tube or digital voltmeter, nominal voltage 375 to 415 mV.

At 100 kHz the output dc voltage may not deviate from the value measured at 50 kHz by more than -6 mV.

Adjust input level to 0 dB (0 Np), f = 100 kHz.

The dc voltage to be 0.9 to 1.18 V at the output (pins 3/6).
Carry out the tests for the second amplifier stage of the first amplifier, 35 D 590a2a as for the first amplifier stage, with the exception of feeding-in between pins 10 and 12 (grounded).

7. Frequency Marker Slide-in Chassis, Type D928

a. General

Carry out visual inspection (ckeck for dry joints, wire breaks and short circuits).

Connect the frequency marker slide-in chassis to the level tracer (right-hand slide-in chassis compartment via test lead, Rel Bv 757 C 3006. Check the voltage values entered in circuit diagram Rel str 3 D 928a with a "Multizet" microammeter.

b. Marker Lines

With faults occurring in the circuit for the marker lines, connect the input of the horizontal deflecting voltage (contact pin 27) to chassis. Measure voltage between anodes of tube 1 with a "Multizet" microammeter and readjust to 0 V $\pm$0.05 V with potentiometer P3. Measure the voltage between the anodes of tube 2 and adjust with potentiometer P2 to 0 V $\pm$0.05 V. After this the voltage at the anodes of tubes 1 and 2 should be +80 V $\pm$10% and at the cathode +2.3 V $\pm$20%. Potentiometers P2 and P3 should be somewhere near their central positions. If 0 V cannot be adjusted between anodes, test tubes 1 and 2, the circuit and the supply voltages; at P2 and P3 the voltages applied should read +11 V and -11 V.

With this setting, the oscillator incorporating tube 3 should oscillate at approx. 500 kHz and generate a dc voltage of approx. 8 V at the output (R29) - (turn P1 "Brightness" to the right-hand stop).

If it fails to oscillate, unsolder C5 and C9 at the common junction with C6 and R8 and join the connections of capacitors C5 and C9. Should the oscillator still refuse to oscillate, then examine the circuit (particularly Gr5 and Gr6). Should the oscillator oscillate, then examine diodes Gr1 to Gr4. After eliminating the fault, resolder C5 and C9 and disconnect the connection to chassis from the input.

c. Frequency Line

For the purpose of testing and readjusting the amplifier, apply a 1-kHz voltage of 5 V rms to the input. Turn potentiometer P1 "Brightness, Marker Lines" to the left-hand stop.

Measure the ac voltage at the cathodes of tube 4 with an RF model "Multizet" instrument. The voltages should be about equally great (approx. 5 V rms), small deviations can be corrected with R55.

The control "Brightness, Frequency Line" should permit adjustment of the voltage between output pin 10 and pin 8 between -24 and -9.5 V.

The voltage at R64 should be set to -9.5 V.

d. Frequency Calibration Marker

In the case of a faulty frequency marker, examine transistor Ts1 and the circuit. For obtaining vertical displacement, a dc voltage of approx. -14 to +67 V must be adjustable with control P4 at the output (plug strip, pin 2).

S T Ü C K L I S T E

Vorbemerkung

Unter Symbol stehen die in den Stromläufen verwendeten Abkürzungen für die Bauteile in alphabetischer und - soweit möglich - in numerischer Reihenfolge. Mit Stück ist die Anzahl der gleichen Bauteile innerhalb der Geräte oder der Baugruppe bezeichnet. In der Spalte Gegenstand sind außer dem Namen des Bauteils auch seine Hauptkennwerte angegeben. Mit der Bestellbezeichnung ist das Bauteil durch einen Abkürzungs-Code oder eine Bauvorschrift eindeutig gekennzeichnet.

Es bedeuten:

bei einem Widerstand: 300 kΩ ±5% 0,5 W

300 kΩ	Nennwert des Widerstandes
±5%	Toleranz des Nennwiderstandes
0,5 W	Belastbarkeit bezogen auf Umgebungstemperatur 20°C

bei einem Kondensator: 1000 pF ±20% 125 V-

1000 pF	Nennwert der Kapazität (1 pF = 1 µµF = 10^{-12} F)
±20%	Toleranz der Nennkapazität
125 V-	zulässige Betriebsgleichspannung

bei einem Übertrager:

Wicklg.I (1a,2a,3a)	Wicklg.II (rtsw,gesw, rtgn,gegnsw)+
440 Wdg 0,1 CuL 75 Ω	
228 µH ±2%	720 Wdg HFL SS 60x0,03 35 Ω
Abgriff(2a): 210 Wdg	1.Abgriff(gesw): 46 Wdg
	2.Abgriff(rtgn): 190 Wdg

Wicklg.I (1a,2a,3a)	
440 Wdg	440 Windungen, Anfang Lötöse 1a, Ende 3a
0,1 CuL	aus Kupferdraht (Cu); 0,1 mm ∅; lackisoliert (L)
75 Ω	Gleichstromwiderstand der Wicklung I
228 µH	Induktivität
Abgriff(2a): 210 Wdg	Abgriff bei der 210.Windung, Lötöse 2a
Wicklg.II	sinngemäß wie bei Wicklung I
HFL SS 60x0,03	Hochfrequenzlitze 2fach seidenumsponnen (SS), aus Kupferdraht 60x0,03 mm ∅

bei einem Gleichrichter: 50 V/250 mA

50 V	Anschluß-Wechselspannung
250 mA	entnehmbarer Betriebsstrom

bei Halbleitern:

J_D	Durchlaßstrom bei +1 V	Dioden
U_{Sp}	Sperrspannung	Dioden
J_Z	Zenerstrom	Zenerdioden
U_Z	Zenerspannung	Zenerdioden
r_Z	Dynamischer Zener-Widerstand bei J_Z	Zenerdioden
R_{20}	Widerstand bei 20°C z.B. von Heißleitern	
TK	Temperaturkoeffizient	

+ Farb-Kurzzeichen

bl = blau	ge = gelb	gr = grau	sw = schwarz	rs = rosa
br = braun	gn = grün	rt = rot	ws = weiß	rtsw = rot/schwarz

P A R T S L I S T

Introductory Remark

The "SYMBOL" column shows the abbreviations used in the circuit diagrams in alphabetic and, to the extent possible, numerical order. "QTY" denotes the number of identical components within the devices or the subassembly. The "DESCRIPTION" column gives, apart from the designation of the components, its principal characteristic data. The "ORDERING DATA" column designates the component nonambiguously by an abbreviation code or a component specification.

There denotes, for instance

with a resistor: 300 kΩ ±5%; 0,5 W

- 300 kΩ . . . . . Nominal value of the resistance
- ±5% . . . . . Tolerance of the nominal resistance
- 0,5 W . . . . . Wattage rating, as referred to an ambient temperature of 20°C

with a capacitor: 1000 pF ±20%; 125 V-

- 1000 pF . . . . . Nominal value of the capacitance (1 pF = 1 µµF = 10^{-12} F)
- ±20% . . . . . Tolerance of the nominal capacitance
- 125 V- . . . . . Permissible DC operating voltage

with a transformer:

Wicklg.I (1a,2a,3a)	Wicklg.II (rtsw,gesw, rtgn,gegnsw)+
440 Wdg 0,1 CuL 75 Ω	720 Wdg HFL SS 60x0,03 35 Ω
228 µH ±2%	1.Abgriff(gesw): 46 Wdg
Abgriff(2a): 210 Wdg	2.Abgriff(rtgn): 190 Wdg

Wicklg.I (1a,2a,3a)

- 440 Wdg . . . . . 440 turns, start soldering lug 1a, end 3a
- 0,1 CuL . . . . . of copper wire (Cu); 0.1 mm dia., enamelled (L)
- 75 Ω . . . . . DC resistance of winding I
- 228 µH . . . . . Inductance
- Abgriff(2a): 210 Wdg Tap at soldering lug 2a at the 210th turn

Wicklg.II . . . . . Analogously to winding I

HFL SS 60x0,03 . . . RF copper Litz wire, with double silk covering, 60x0.03 mm dia.

with a rectifier: 50 V/250 mA

- 50 V . . . . . Primary AC voltage
- 250 mA . . . . . Available operating current

with semiconductors:

- J_D . . . . . Forward current with +1 v } Diodes
- U_{Sp} . . . . . Inverse voltage }
- J_Z . . . . . Zener current } Zener diodes
- U_Z . . . . . Zener voltage }
- r_Z . . . . . Dynamic Zener resistance at J_Z }
- R_{20} . . . . . Resistance at 20°C, e.g., of thermistors
- TK . . . . . Temperature coefficient

+ Color symbols

bl = blue	ge = yellow	gr = gray	sw = black	rs = pink
br = brown	gn = green	rt = red	ws = white	rtsw = red/black

Symbol SYMBOL	Stck QTY	Gegenstand DESCRIPTION	Bestellangabe ORDERING DATA	Seite PAGE
	1	Hochspannungsteil HIGH-VOLTAGE SECTION	Rel Sk 35 D 433c1a	5-04
	1	Gleichspannungsverstärker DC-AMPLIFIER	Rel Sk 35 D 434c1a	5-07
	1	Differenzierverstärker DIFFERENTIATING AMPLFIER	Rel Sk 35 D 435c1a	5-10
	1	Sägezahn- und Horizontal-verstärker SAWTOOTH AND HORIZONTAL AMPLIFIER POWER SUPPLY UNIT	Rel Sk 35 D 436c1a	5-15
	1	Netzteil POWER SUPPLY UNIT	Rel Sk 35 D 437c1a	5-21
	1	Ablenkeinheit DEFLECTING UNIT	AS 007 N/16 (Fa.Gerhard)	
	nach Bedarf zu beordernde Einschübe SLIDE-IN CHASSIS TO BE ORDERED ACCORDING TO REQUIREMENTS			
	1	ZF-Verstärker IF-AMPLIFIER Np, dB	Rel Sk 3 D 916c1a 2a	5-25
		Breitbandverstärker WIDEBAND AMPLIFIER		
	1	Np, dB, dBm	Rel Sk 3 D 917b1a, 2a,3a	5-31
	1	02...1600 kHz	Rel Sk 3 D 918a1a, 2a	5-39
	1	30 Hz...30 kHz	Rel Sk 3 D 919a1a, 2a	5-50
	1	Logarithmischer ZF-Verstärker LOGARITHMIC IF AMPLIFIER	Rel Sk 3 D 920a1a 2a	5-60
	1	Frequenzmarken-Einschub FREQUENCY MARKER SLIDE-IN CHASSIS	Rel Sk 3 D 928a1a	5-66
	nach Bedarf zu beorderndes Zubehör ACCESSORIES TO BE ORDERED ACCORDING TO REQUIREMENTS			
	1	Rastgeber LEVEL PATTERN SENDER	Rel Sk 3 B 945a1a	5-70
	1	Prüfkabel TEST CORD	Rel Bv 657 C 300b	

Hochspannungsteil Rel 35 D 433c1a (Ausgabe II)
HIGH-VOLTAGE SECTION (ISSUE II)

		Bauteileplatte **COMPONENT BOARD**	
	1		Rel Sk 35 D 730c1a 5-06
	1		Rel Sk 35 D 731c1a 5-07
		MKH-Kondensator **MKH-CAPACITOR**	
C 8	1	0,01µF ±20%; 600V-	B32220-A6103-M
C 26	1	0,022µF ±20%; 250V-	B32220-J3223-M
C 19	1	MKL-Kondensator MKL CAPACITOR 0,05µF ±20%; 1kV	B32227-A0503-M
		Styroflex-Kondensator **STYROFLEX CAPACITOR**	
C 20	1	100pF ±5%; 500V-	B31141-A5101-J
C 21	1	50pF ±5%; 500V-	B31141-A5500-J
C 25	1	2920pF ±2%; 250V-	B31142-A2292-G200
Gr 3,4	2	Flachgleichrichter FLAT-TYPE RECTIFIER 250V / 40mA	V23201-F1075
		Spule **COIL**	
L 1	1	(9 Rel sp 6e) Wicklg. I (1,4) 175 Wdg 0,26 CuL 3,1Ω 10,1 bis 11,1mH	Rel Bv 622 P 3262
L 4	1	(Rel sp 82) 206,5 Wdg 0,14 CuL 7,7Ω 6,1 bis 6,7mH	Rel Bv 622 W 3013
L 2,3	2	Drossel CHOKE 1,5A / 3µH	B82501-DA24
		Schichtwiderstand **LAYER-TYPE RESISTOR**	
R 4,15	2	100Ω ±10%; 0,33W	B51263-A4101-K
R 5	1	50kΩ ±10%; 0,33W	B51263-A4503-K
R 9	1	20kΩ ±10%; 0,33W	B51263-A4203-K
R 16	1	1Ω ±2%; 0,25W	SWD 0,25 1 Ω ±2% Kl.2 (Fa. Rosenthal)
R 17	1	300kΩ ±10%; 0,33W	B51263-A4304-K
R 20	1	50kΩ ±5%; 0,33W	B51264 A 50 K 5/2

		Schichtwiderstand LAYER-TYPE RESISTOR	
R 21	1	100Ω ±10%; 0,5W	B 51264 A 100 Ω 10/5
R 22	1	600Ω ±10%; 0,75W	B 51265 A 600 Ω 10/5
R 23	1	200kΩ ±10%; 0,33W	B 51263-A4204-K
R 26	1	250kΩ ±10%; 0,33W	B51263-A4254-K
R 27,28	2	1MΩ ±10%; 0,33W	B51263-A4105-K
R 32	1	8kΩ ±5%; 0,33W	B51264 A 8 K 5/2
R 35	1	21kΩ ±1%; 0,5W	B 51266 A 21 K 1/0,5
R 36	1	3kΩ ±1%; 0,1W	B51263-S9302-F
		Schichtdrehwiderstand LAYER-TYPE VARIABLE RESISTOR	
R 10	1	10kΩ / lin 0,1W	10 kΩ lin Rel TL 613 C 3005a1
R 18,25	2	1MΩ / lin 0,1W	1 MΩ lin Rel TL 613 C 3005a1
R 37	1	5kΩ / lin 0,1W	5 kΩ lin Rel TL 613 C 3005a1
Ü 1	1	Zeilentransformator LINE TRANSFORMER	AT 917-0 (Fa. Lorenz)
		Übertrager TRANSFORMER	
Ü 2	1	(Rel sp 74b) Wicklg. I (3,4) 600 Wdg 0,10 CuL 80Ω 1,6H Wicklg. II (get,gert) 5 Wdg 0,5/0,9 YV; 0,06Ω Wicklg. III (gn,gn) 5 Wdg 0,5/0,9 YV; 0,06Ω	Rel Bv 622 S 3335
Ü 3	1	(Rel sp 74b) Wicklg. I (2,3,4,5) 276 Wdg 2x0,2 CuL paral. 5,1Ω 1. Abgriff (3): 250 Wdg 2. Abgriff (4): 272 Wdg	

Bauteileplatte Rel 35 D 730c1a (Ausgabe I)
COMPONENTS BOARD (ISSUE I)

		Styroflex-Kondensator **STYROFLEX CAPACITOR**	
C 1	1	70pF ±5%; 500V-	B31141-A5700-J
C 2	1	6000pF ±5%; 250V-	B31143-A2602-J
C 5	1	300pF ±20%; 500V-	B31141-A5301-M
C 6	1	5000pF ±20%; 125V-	B31142-A1502-M
C 23	1	33pF ±10%; 500V-	B31140-A5330-K
		MKH-Kondensator **MKH-CAPACITOR**	
C 3,4	2	0,022µF ±20%; 300V-	B32220-A3223-M
C 7	1	0,047µF ±20%; 600V-	B32220-A6473-M
C 14	1	0,05µF ±20%; 1kV	B32227-A0503-M
C 11	1	**MKL-Kondensator** **MKL-CAPACITOR** 1µF ±20%; 250V-	B32110-C2105-M
Gr 1	1	**Diode** **CRYSTAL DIODE** J_D=100mA bei/AT 0,85V; U_{Sp}=80V-	OA 182 (Fa. Telefunken)
		Schichtwiderstand **LAYER-TYPE RESISTOR**	
R 1,8	2	6kΩ ±5%; 0,5W	B 51263 A 6 K 5/2
R 2,6,28	3	100kΩ ±5%; 0,25W	B51263-A2104-J
R 3	1	10kΩ ±5%; 0,25W	B51263-A2103-J
R 11,13	2	2,5MΩ ±10%; 0,5W	B51264 A 2,5 M 10/5
R 12	1	1,2MΩ ±10%; 0,33W	B51263-A4125-K
R 29	1	220kΩ ±5%; 0,25W	B51263-A2224-J

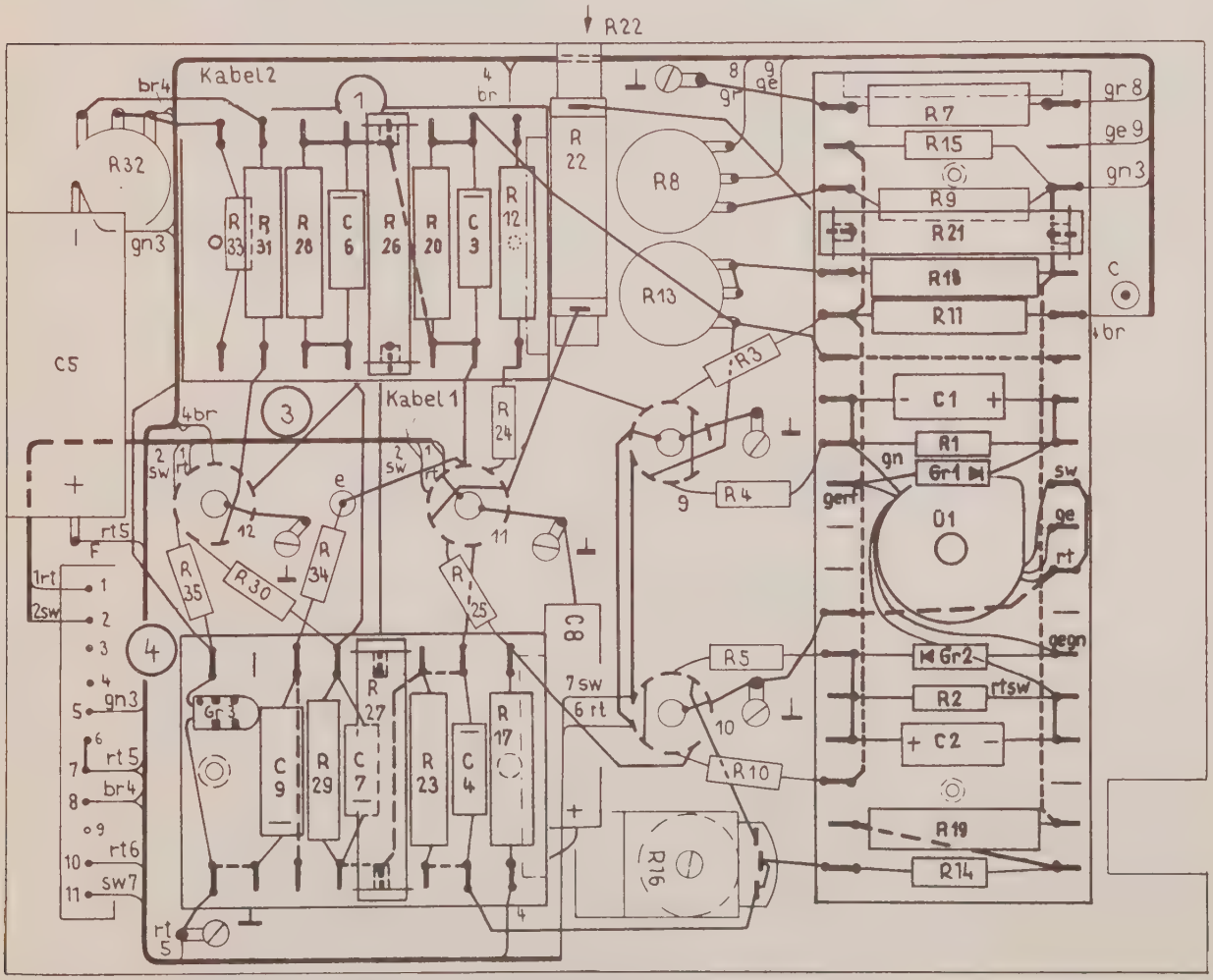
Bauteileplatte Rel 35 D 731c1a (Ausgabe I)
COMPONENTS BOARD (ISSUE I)

C 9	1	MKL-Kondensator MKL-CAPACITOR 0,22µF ±20%; 160V-	B32110-C1224-M
		FKH-Kondensator FKH-CAPACITOR	
C 10	1	0,015µF ±20%; 400V-	B 32210 A 0,015 M 400
C 17	1	0,02µF ±20%; 400V-	B32210 A 0,02 M 400
C 12,13,15 16,18,22	6	MKH-Kondensator MKH-CAPACITOR 0,1µF ±20%; 600V	B32220-A6104-M
Gr 5	2	Diode CRYSTAL DIODE J_D=175mA; U_{Sp}=300V-	BAY 30
		Schichtwiderstand LAYER-TYPE RESISTOR	
R 7	1	50kΩ ±2%; 0,33W	B 51264 A 50 K 2/2
R 14	1	80kΩ ±10%; 0,33W	B 51265-A 80 K 2/2
R 19	1	500kΩ ±10%; 0,33W	B51263-A4504-K
R 30,31	2	1MΩ ±1%; 0,25W	B51265 A 1 M 1/0,5
R 33,34	2	250kΩ ±1%; 0,15W	B 51264 A 250 K 1/0,5

Gleichspannungsverstärker Rel 35 D 434c1a (Ausgabe I)
DC-AMPLIFIER (ISSUE I)

		Bauteileplatte COMPONENTS PANEL	
	1	C44249-A8-B52	Rel Sk 35 D 732c1a 5-09
	1	C44249-A8-B52	Rel Sk 35 D 733c1a 5-09
	1	C44249-A8-B54	Rel Sk 35 D 734c1a 5-10
		Elektrolyt-Kondensator ELECTROLYTIC CAPACITOR	
C 5	1	25µF +50/-10%; 350V-	B43651-A4256-T
C 8	1	2µF +50/-10%; 350V-	B43711-A4205-T
R 3,4,5,10 24,25,30	7	Schichtwiderstand LAYER-TYPE RESISTOR 5kΩ ±10%; 0,33W	B51263-A4502-K

		Schichtwiderstand LAYER-TYPE RESISTOR	
R 34	1	100kΩ ±5%; 0,25W	B51263-A2104-J
R 35	1	220Ω ±5%; 0,25W	B51263-A2221-J
		Schichtdrehwiderstand LAYER-TYPE VAR RESISTOR	
R 8	1	5kΩ lin 0,1W	5 kΩ lin Rel TL 613 C 3005a1
R 13	1	1kΩ lin 0,1W	1 kΩ lin Rel TL 613 C 3005a1
R 16	1	500Ω lin 0,1W	500 Ω lin Rel TL 613 C 3005a1
R 32	1	200kΩ log 0,05W	200 kΩ log Rel TL 613c 3005a1
R 22	1	Drahtspindelwiderstand WIRE-WOUND SPINDLE RESISTOR 4kΩ ±40%; 1,4W	B58125-A0402-A000



Gleichspannungsverstärker — Rel ms 35 D 434c1a (Ausgabe I)
DC AMPLIFIER — Rel ms 35 D 434c1a (ISSUE I)

Bauteileplatte Rel 35 D 732c1a (Ausgabe I)
COMPONENTS BOARD (ISSUE I)

		Styroflex-Kondensator STYROFLEX CAPACITOR	
C 3	1	10pF ±1pF; 500V-	B31141-A5100-A
C 6	1	100pF ±20%; 500V-	B31141-A5101-M
		Schichtwiderstand LAYER-TYPE RESISTOR	
R 12	1	340kΩ ±1%; 0,5W	B 51266 A 340 K 1/0,5
R 20	1	80kΩ ±1%; 0,5W	B 51266 A 80 J 1/0,5
R 26	1	30kΩ ±5%; 2W	30 K 5% 2 DIN 41404 R
R 28	1	1MΩ ±1%; 0,25W	B 51265 A 1 M 1/0,5
R 31	1	25kΩ ±5%; 0,5W	B 51265 A 25 K 5/2
R 33	1	500kΩ ±10%; 0,33W	B51263-A4504-K

Bauteileplatte Rel 35 D 733c1a (Ausgabe I)
COMPONENTS BOARD (ISSUE I)

		Styroflex-Kondensator STYROFLEX CAPACITOR	
C 4	1	10pF ±1pF; 500V-	B31141-A5100-A
C 7	1	100pF ±20%; 500V-	B31141-A5101-M
C 9	1	MKH-Kondensator MKH CAPACITOR 0,1µF ±20%; 300V-	B32220-A3104-M
Gr 3	1	Zenerdiode TENER DIODE J_Z=20mA; U_Z=5V; r_Z=30Ω	SZ 5 K St
		Schichtwiderstand LAYER-TYPE RESISTOR	
R 17	1	340kΩ ±1%; 0,5W	B 51266 A 340 K 1/0,5
R 23	1	80kΩ ±1%; 0,5W	B 51266 A 80 K 1/0,5
R 27	1	30kΩ ±5%; 2W	30 K 5% 2 DIN 41404
R 29	1	1MΩ ±5%; 0,25W	B 51265 A 1 M 1/0,5

Bauteileplatte Rel 35 D 734c1a (Ausgabe 1)
COMPONENTS BOARD (ISSUE 1)

C 1,2	2	Elektrolyt-Kondensator ELECTROLYTIC CAPACITOR 5µF +50/-20%; 15V-	B41951-A4505-S
Gr 1,2	2	Richtleiter CRYSTAL DIODE J_D=50nA; U_{Sp}=100V-	AAY 25
		Schichtwiderstand LAYER-TYPE RESISTOR	
R 1,2	2	20kΩ ±10%; 0,33W	B51263-A4203-K
R 7	1	50kΩ ±1%; 0,5W	B 51266 A 50 K 1/0,5
R 9	1	27kΩ ±1%; 0,25W	B 51265 A 27 K 1/0,5
R 11	1	760kΩ ±1%; 0,25W	B 51265 A 760 K 1/0,5
R 14	1	500Ω ±5%; 0,25W	B51263-A2501-J
R 15	1	255kΩ ±1%; 0,15W	B 51264 A 255 K 1/0,5
R 18,19	2	30kΩ ±1%; 0,5W	B 51266 A 30 K 1/0,5
R 21	1	25kΩ ±5%; 2W	25 K 5% 2 DIN 41404-R
Ü 1	1	Übertrager TRANSFORMER (9 Rel sp 6c) Wicklg. I (ge,rt) 24 Wdg 0,25 CuL 0,5Ω 1,15...1,78mH	Rel Bv 622 P 3269

Differenzier-Verstärker Rel 35 D 435c1a (Ausgabe II)
DIFFERENTIATING AMPLIFIER (ISSUE II)

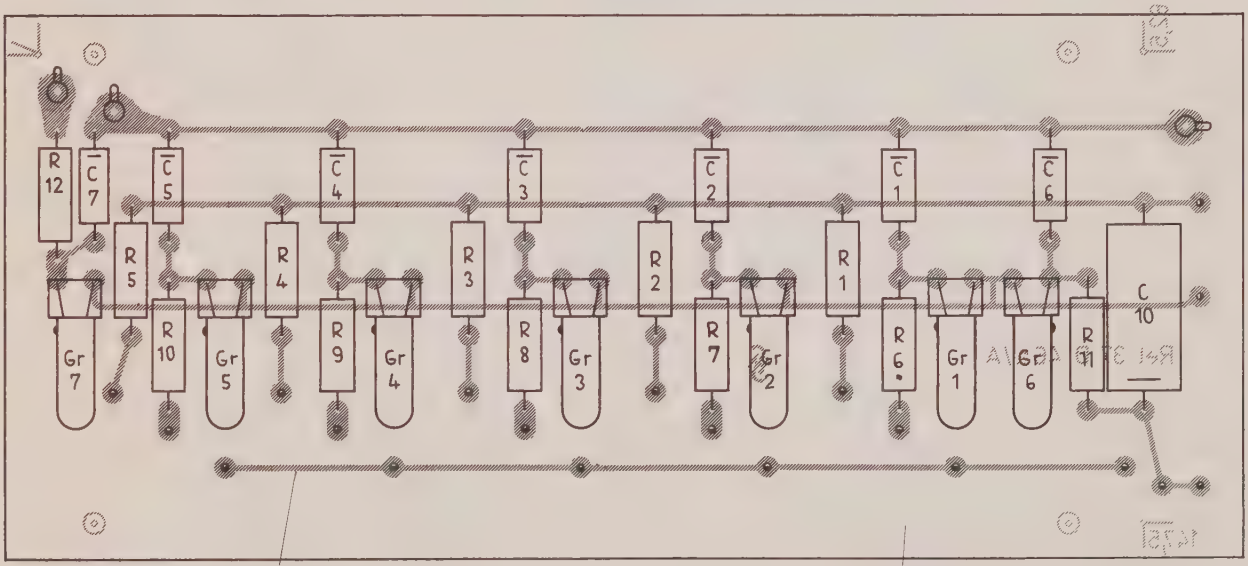
	1	Komparator-Baugruppe COMPARATOR SUBASSEMBLY	Rel 35 D 549c1a 5-14
		Styroflex-Kondensator STYROFLEX CAPACITOR	
C 20,70	2	30pF ±1pF; 125V-	B31140-A1300-A
C 24,74	2	2500pF ±20%; 125V-	B31142-A1252-M
C 47	1	100pF ±20%; 125V-	B31140-A1101-M
C 50	1	500pF ±20%; 125V-	B31140-A1501-M
C 21,35,44 48,51,54 58,71	8	MKH-Kondensator MKH-CAPACITOR 0,1µF ±20%; 250V-	B32220-J3104-M

		MKH-Kondensator MKH-CAPACITOR	
C 23,27,31 46,49,52 53,55,59 73,77,81	12	0,01µF ±20%; 300V-	B32220-A3103-M
C 26,30,33,56 61,76,80,83	8	0,022µF ±20%; 300V-	B32220-A3223-M
C 28,29,32,34 57,60,70,79 82	9	0,047µF ±20%; 300V-	B32220-A3473-M
C 102	1	0,01µF ±20%; 250V-	B32220-J3103-M
C 36,37,38,62 63,64,85,86	8	Keramik-Durchführungskondensator CERAMIC LOAD-THROUGH CAPACITOR 5000pF +30/-20%; 500V-	B37480-A5502-R000
		Elektrolyt-Kondensator ELECTROLYTIC CAPACITOR	
C 95,98	2	500µF +50/-20%; 70V-	B41711-B8507-S
C 99,100	2	250µF +50/-20%; 35V-	B41711-A7257-S
		MKL-Kondensator MKL-CAPACITOR	
C 25,65,75	3	0,1µF ±20%; 100V-	B32110-C0104-M
C 96,101	2	0,15µF ±20%; 63V-	B32110-D9154-M
C 84	1	Tantal-Elektrolyt-Kondensator TANTAL-ELECTROLYTIC-CAPACITOR 10µF ±20%; 35V-	B45170-J4106-M
		Richtleiter CRYSTAL DIODE	
Gr 15,32	2	J_D=200mA; U_{Sp}=100V-	OA5 (Fa. Valvo)
Gr 16,17,19,20 25,27,28,33 35	9	J_D=100mA bei/AT 0,85V; U_{Sp}=80V-	OA 182(Fa. Telefunken)
Gr 18,26,34	3	J_D=50mA; U_{Sp}=100V-	AAY 25
Gr 40,42	2	Flachgleichrichter FLAT-TYPE RECTIFIER 60V- / 300mA	V23201-F1175
Gr 41,43	2	Zener-Diode ZENER DIODE J_Z=5mA; U_Z=8,2V; r_Z=7Ω	SZ 8 KB
L 1	1	HF-Leitung RF-LEAD 120Ω / 365mm / MM	Rel Bv 657 A 268 d 101

		Schichtwiderstand LAYER-TYPE RESISTOR	
R 29,30	2	20kΩ ±10%; 0,33W	B51263-A4203-K
R 31,112	2	4,7kΩ ±5%; 0,25W	B51263-A2472-J
R 32,35,37,40 42,45,47,71 75,77,80,82 85,87,90,91 94,95,111,115 116,122,123,126 127,135,136	27	100Ω ±10%; 0,33W	B51263-A4101-K
R 33,34,38,39 72,74,78,79 83,84,88,89 113,114,120,121	16	2kΩ ±10%; 0,33W	B51263-A4202-K
R 36,41,46,76 81,86,92,96,117 124,128	11	100kΩ ±5%; 0,25W	B51263-A2104-J
R 44,125	2	3kΩ ±10%; 0,33W	B51263-A4302-K
R 48,97,129	3	600Ω ±10%; 0,33W	B51263-A4601-K
R 49,100,132	3	80Ω ±10%; 0,33W	B51263-A4800-K
R 50,99,130	3	10kΩ ±10%; 0,33W	B51263-A4103-K
R 51	1	25kΩ ±10%; 0,33W	B51263-A4253-K
R 52	1	8,2kΩ ±5%; 0,25W	B51263-A2822-J
R 53	1	200Ω ±10%; 0,33W	B51263-A4201-K
R 54	1	2kΩ ±5%; 0,33W	B 51264 A 2 K 5/2
R 70,93	2	1kΩ ±10%; 0,33W	B51263-A4102-K
R 73	1	500Ω ±10%; 0,33W	B51263-A4501-K
R 98	1	820Ω ±5%; 0,25W	B51263-A2821-J
R 110	1	40kΩ ±5%; 0,25W	B51263-A2403-J
R 118	1	2,5MΩ ±10%; 0,5W	B 51264 A 2,5 M 10/5
R 119	1	200kΩ ±10%; 0,33W	B51263-A4204-K
R 145,160	2	1kΩ ±5%; 1W	B 51266 A 1 K 5/2
R 146,161	2	50kΩ ±5%; 0,25W	B51263-A2503-J
R 148,163	2	2kΩ ±5%; 0,25W	B51263-A2202-J
R 149,164	2	1,2kΩ ±5%; 0,25W	B51263-A2122-J
R 152,166	2	500Ω ±5%; 0,25W	B51263-A2501-J
R 167	1	1,5kΩ ±5%; 0,25W	B51263-A2152-J
		Schichtdrehwiderstand LAYER-TYPE VAR RESISTOR	
P 1-5	5	100kΩ lin 0,1W	100 kΩ lin Rel TL 613 C 3005a1
R 43,101,147,162	4	100kΩ lin 0,1W	100 kΩ lin Rel TL 613 C 3005a1
R 131,168	2	10kΩ lin 0,1W	10 kΩ lin Rel TL 613 C 3005a1

R 151,165	2	Schichtdrehwiderstand LAYER-TYPE VAR RESISTOR 500Ω lin 0,1W	500 Ω lin Rel TL 613 C 3005a1
S 1	1	Drehschalter ROTARY SWITCH	Rel sch 197e Tz 1
		Transistor TRANSISTOR	
Ts 1,3	2		AUY 15
Ts 2,4	2		ADY 19
Ts 5	1		BFY 34
		Schalenkernspule SHELL-CORE COIL	
Ü 1	1	(9 Rel sp 6c) Wicklg. I (ge,rt) 32 Wdg 0,22 Cu2L 0,77Ω Wicklg. II (gert,gn) 18 Wdg 0,40 Cu2L 0,15Ω	Rel Bv 622 P 3449
Ü 2,3	2	(9 Rel sp 6c) Wicklg. I (ge,rt) 32 Wdg 0,22 Cu2L 0,77Ω Wicklg. II (gert,gn) 18 Wdg 0,40 Cu2L 0,15Ω	Rel Bv 622 P 3450

C 1-7	7	Styroflex-Kondensator STYROFLEX CAPACITOR 30pF ±1pF; 125V-	B31140-A1300-A
C 10	1	MKL-Kondensator MKL-CAPACITOR 1µF ±20%; 100V-	B32110-C0105-M
Gr 1-7	7	Richtleiter CRYSTAL DIODE J_D = 20mA; U_{Sp} = 100V-	OA 5 (Fa. Valvo)
		Schichtwiderstand LAYER-TYPE RESISTOR	
R 1-5	5	10kΩ ±5%; 0,25W	B51263-A2103-J
R 6-12	7	20kΩ ±5%; 0,25W	B51263-A2203-J



Strombahnen auf der Rückseite
CURRENT PATHS ON THE REAR

Rel 37 D 46

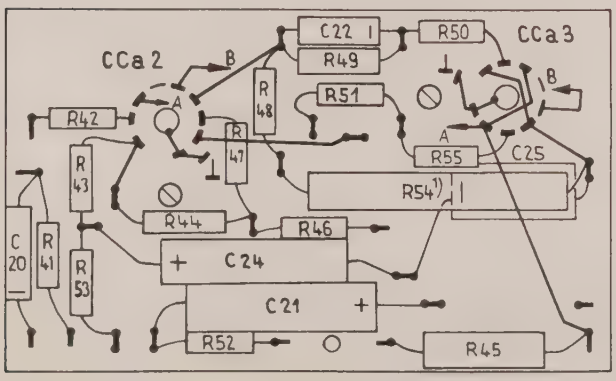
Komparator-Baugruppe Rel ms 35 D 549c1a (Ausgabe I)
COMPARATOR SUBASSEMBLY Rel ms 35 D 549c1a (ISSUE I)

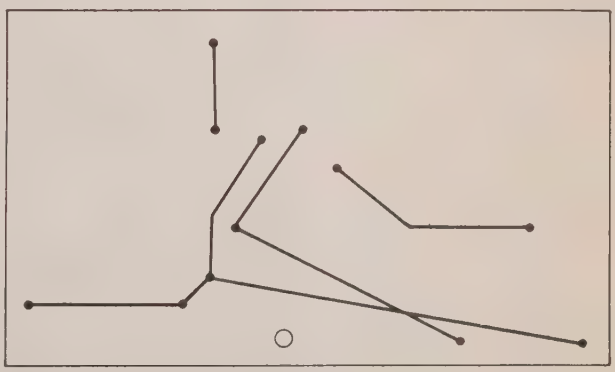
	1	Sägezahnverstärker SAWTOOTH AMPLIFIER	Rel Sk 35 D 580c1a	5-17
		Bauteileplatte COMPONENTS BOARD		
	1		Rel Sk 35 D 735c1a	5-18
	1		Rel Sk 35 D 736c1a	5-20
C 11	1	Elektrolyt-Kondensator ELECTROLYTIC CAPACITOR 250µF +50/-20%; 15V-	B41611-A4257-S	
		Schichtdrehwiderstand LAYER-TYPE VAR RESISTOR		
P 6	1	50kΩ lin 0,2W	50 kΩ lin Rel TL 613 C 3003a2	
P 7	1	5kΩ lin 0,2W	5 kΩ lin Rel TL 613 C 3003a3	
P 8	1	100Ω lin 0,2W	100 Ω lin Rel TL 613 C 3004a2	
P 10	1	25kΩ neg. log. 0,1W	25 kΩ neg.log. Rel TL 613 C 3004a2	
P 11	1	5kΩ lin 0,2W	5 kΩ lin Rel TL 613 C 3004a1	
R 40	1	500kΩ lin 0,2W	500 kΩ lin Rel TL 513 C 3003a1	
P 9	1	Drahtspindelwiderstand WIRE-WOUND SPINDLE RESISTOR 9Ω +40%; 3W	B58125-J0090-A000	
		Schichtwiderstand LAYER-TYPE RESISTOR		
R 7,9	2	100Ω ±10%; 0,33W	B51263-A4101-K	
R 23	1	6Ω ±1%; 3W	6 Ω 1% 0,5 DIN 41406 R	
R 24	1	5Ω ±1%; 3W	5 Ω 1% 0,5 DIN 41406 R	
R 30	1	800Ω ±5%; 0,33W	B 51264 A 800 Ω 5/2	
R 31	1	12,5kΩ ±1%; 0,25W	B 51265 A 12,5 K 1/0,5	
R 32	1	180kΩ ±5%; 0,25W	B51263-A2184-J	

R 60	1	Metallschichtwiderstand METALLIZED LAYER-TYPE RESISTOR 7,365kΩ ±0,2%; 0,25W	B54993-A9732-C654
S 1	1	Schalter SWITCH 2polig; 1 Ebene; 2 Stellungen 2-PLOE; 1-DECK; 2-POSITIONS	Rel sch 300aa Form B
		Transistor TRANSISTOR	
Ts 2,6	2		ADY 13
Ts 3	1		AUY 15
Ts 4,5,7	3		AUY 24

Sägezahnverstärker Rel Sk 35 D 580c1a (Ausgabe I)
SAWTOOTH AMPLIFIER (ISSUE I)

C 20	1	MKL-Kondensator MKL-CAPACITOR 0,1µF ±20%; 100V-	B32110-C0104-M
C 21,24	2	Elektrolyt-Kondensator ELECTROLYTIC CAPACITOR 2µF +50/-10%; 250V-	B43711-A2205-T
C 22	1	Styroflex-Kondensator STYROFLEX CAPACITOR 12pF ±1pF; 500V-	B31141-A5120-F
C 25	1	MKH-Kondensator MKH CAPACITOR 0,047µF ±20%; 600V-	B32220-A6473-M
		Schichtwiderstand LAYER-TYPE RESISTOR	
R 41	1	2,5MΩ ±5%; 0,33W	B 51264 A 2,5 M 5/2
R 42,47,50,55	4	100Ω ±10%; 0,33W	B51263-A4101-K
R 43	1	100kΩ ±5%; 0,25W	B51263-A2104-J
R 44,46,49	3	500kΩ ±5%; 0,33W	B 51264 A 500 K 5/2
R 45	1	10kΩ ±5%; 1W	B 51266 A 10 K 5/2
R 48	1	125kΩ ±5%; 0,25W	B51263-A2124-J500
R 51	1	1MΩ ±5%; 0,33W	B 51264 A 1 M 5/2
R 52	1	300kΩ ±5%; 0,25W	B51263-A2304-J
R 53	1	400Ω ±5%; 0,25W	B51263-A2401-J
R 54	1	4kΩ ±10%; 2W	B 51267 A 4 K 10/5



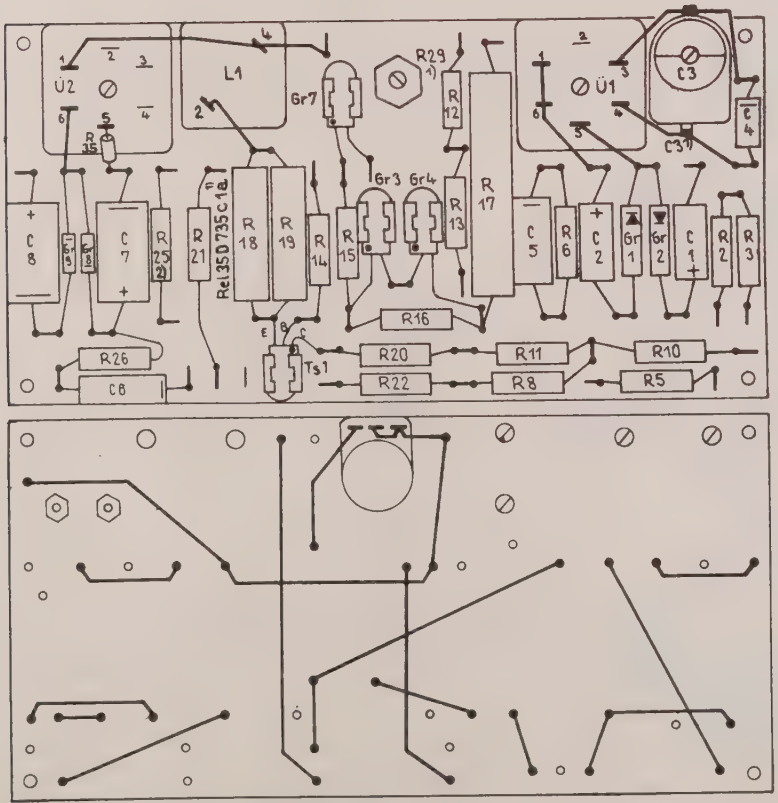


Sägezahnverstärker Rel ms 35 D 580c1a (Ausgabe I)
SAWTOOTH AMPLIFIER Rel ms 35 D 580c1a (ISSUE I)

Bauteileplatte Rel 35 D 735c1a (Ausgabe I)
COMPONENTS BOARD (ISSUE I)

		Elektrolyt-Kondensator ELECTROLYTIC CAPACITOR	
C 1,2	2	1µF +50/-20%; 100V-	B41951-A9105-S
C 7,8	2	100µF ±20%; 10V-	B45170-J1107-M
C 4	1	Styroflex-Kondensator STYROFLEX CAPACITOR 20pF ±1pF; 125V-	B31140-A1200-A
C 5	1	MKH-Kondensator MKH CAPACITOR 0,047µF ±20%; 300V-	B32220-A3473-M
C 6	1	MKL-Kondensator MKL-CAPACITOR 0,1µF ±20%; 100V-	B32110-C0104-M
C 3	1	Lufttrimmer AIR-DIELECTRIC TRIMMER 2...12pF / 250V-	Rel ko 130 fc
Gr 1,2	2	Richtleiter CRYSTAL DIODE J_D = 50mA; U_{Sp} = 100V-	AAY 25
Gr 3,4	2	Germanium-Diode GERMANIUM DIODE J_D = 250mA; U_{Sp} = 25V	OA 7 (Fa. Valvo)
Gr 7	1	Zenerdiode ZENER DIODE J_Z=5mA; U_Z=11,4-12,6V-	SZ 12 KB
Gr 8,9	2	Diode CRYSTAL DIODE J_D = 150mA; U_{Sp} = 80V-	OA 182 (Fa.Telefunken)
L 1	1	Spule COIL (Rel sp 51) Wicklg. I (2,4) 25 Wdg 0,60 CuL 0,07Ω 67,6µH	Rel Bv 622 N 3389
		Schichtwiderstand LAYER-TYPE RESISTOR	
R 2	1	40kΩ ±5%; 0,33W	B 51264 A 40 K 5/2
R 3	1	60kΩ ±5%; 0,33W	B 51264 A 60 K 5/2
R 5	1	2MΩ ±10%; 0,5W	B 51264 A 2 MΩ 10/5
R 6	1	1MΩ ±10%; 0,5W	B 51264 A 1 M 10/5

		Schichtwiderstand LAYER-TYPE RESISTOR	
R 8,20	2	3kΩ ±5%; 0,33W	B 51264 A 3 K 5/2
R 10,22	2	1,5kΩ ±5%; 0,33W	B 51264 A 1,5 K 5/2
R 11	1	600Ω ±5%; 0,33W	B 51264 A 600 Ω 5/2
R 12	1	300Ω ±10%; 0,33W	B51263-A4301-K
R 13	1	800Ω ±5%; 0,33W	B 51264 A 800 Ω 5/2
R 14	1	1kΩ ±5%; 0,33W	B 51264 A 1 K 5/2
R 15	1	3,57Ω ±1%; 0,15W	B 51264 A 3,57 Ω 1/0,5
R 16	1	13Ω ±1%; 0,15W	B 51164 A 13 Ω 1/0,5
R 17	1	300Ω ±2%; 2W	B 51267 A 300 Ω 2/2
R 18,19	2	3,2Ω ±1%; 0,5W	B 51266 A 3,2 Ω 1/0,5
R 21	1	60Ω ±5%; 0,5W	B 51265 A 60 Ω 5/2
R 25	1	3kΩ ±5%; 0,33W	B 51264 A 3 K 5/2
R 26	1	50Ω ±5%; 0,33W	B 51264 A 50 Ω 5/2
R 35	1	10Ω ±5%; 0,33W	B 51264 A 10 Ω 5/2
R 29	1	Schichtdrehwiderstand LAYER-TYPE VAR RESISTOR 200Ω lin 0,1W	200 Ω lin Rel TL 613 C 3005a1
Ts 1	1	Transistor TRANSISTOR	ACY 25

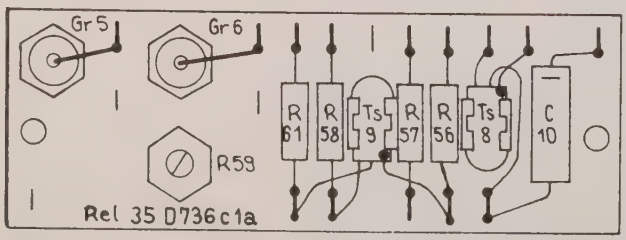


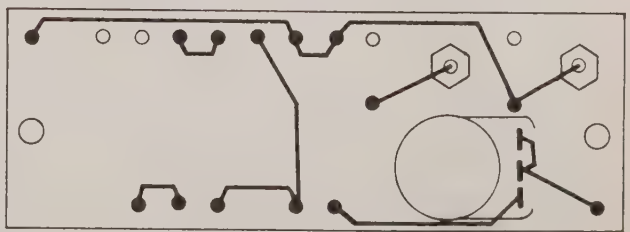
Sägezahn- und Horizontalverstärker
SAWTOOTH AND HORIZONTAL AMPLIFIER

Rel ms 35 D 735c1a (Ausgabe I)
Rel ms 35 D 735c1a (ISSUE I)

		Übertrager TRANSFORMER	
Ü 1	1	Wicklg. I (ge,rt) 16 Wdg 0,35 Wicklg. II (gert,gn) 70 Wdg 0,20 CuL 2,2Ω 9,9...14,8mH Wicklg. III (gegn;gesw) 5 Wdg 0,20 CuL 0,25Ω 0,05...0,076mH	Rel Bv 622 P 3265
Ü 2	1	Wicklg. I (1,2,3,4) 27 Wdg 0,20 CuL 1,0Ω 1. Abgriff (2): 21 Wdg 2. Abgriff (3): 24 Wdg 1,46...2,23mH Wicklg. II (5,6) 20 Wdg 0,20 CuL 0,7Ω 0,90...1,10mH	Rel Bv 622 P 3266

		Bauteileplatte Rel 35 D 736c1a COMPONENTS BOARD	(Ausgabe I) (ISSUE I)
C 10	1	MKL-Kondensator MKL-CAPACITOR 0,22µF ±20%; 50V-	B32110-C9224-M
		Zenerdiode ZENER DIODE	
Gr 5	1	J_Z = 100mA; U_Z = 5-6V-	ZL 5 (Fa. Intermetall)
Gr 6	1	J_Z = 100mA; U_Z = 7V	ZL 7 (Fa. Intermetall)
		Schichtwiderstand LAYER-TYPE RESISTOR	
R 56	1	8,2kΩ ±5%; 0,25W	B51263-A2822-J
R 57	1	1,8kΩ ±5%; 0,25W	B51263-A2182-J
R 58	1	470Ω ±5%; 0,25W	B51263-A2471-J
R 61	1	2,2kΩ ±5%; 0,25W	B51263-A2222-J
R 59	1	Schichtdrehwiderstand LAYER-TYPE VAR RESISTOR 500Ω lin 0,1W	500 Ω lin Rel TL 613 C 3005a1
Ts 8,9	2	Transistor TRANSISTOR	ACY 14





Sägezahn- und Horizontalverstärker
SAWTOOTH AND HORIZONTAL AMPLIFIER

Rel ms 35 D 736c1a (Ausgabe I)
Rel ms 35 D 736c1a (ISSUE I)

		Elektrolyt-Kondensator ELECTROLYTIC CAPACITOR	
C 1	1	50µF +50/-10%; 150V-	B43651-B1506-T
C 2/3	1	50+50µF +50/-10%; 350V-	B43731-A4107-T
C 4/5	1	100+100µF +50/-10%; 250V-	B43731-A2207-T
C 6,12	2	16µF +50/-10%; 450V-	B43651-B5166-T
C 7,8,9,10	4	2500µF +50/-20%; 15V-	B41711-A4258-S
C 11	1	5000µF +50/-20%; 15V-	B41711-A4508-S
C 14	1	25µF +50/-10%; 250V-	B43651-B2256-T
C 13	1	MKH-Kondensator MKH-CAPACITOR 0,022µF ±20%; 300V-	B32220-A3223-M
		Flachgleichrichter FLAT-TYPE RECTIFIER	
Gr 1	1	90V / 150mA	V23201-F1084
Gr 2a,b	2	125V / 250mA	V23201-F1238
Gr 3a,b	2	125V / 500mA	V23201-F1138
Gr 4	1	390V / 90mA	V23201-F1121
Gr 5,6,7,8	4	30V / 1200mA	V23201-F1092
Gr 9	1	Säulengleichrichter COLUMIN RECTIFIER 1,5 / 20V-	PT 11a 22/1
		Drossel CHOKE	
L 1	1	(Zub. tr M 55a) Wicklg. I (2,3) 2470 Wdg 0,27 CuL 86Ω 2,2H	Rel Bv 621 F 3087
L 2	1	(Zub. tr. M 74a) Wicklg. I (2,3) 2910 Wdg 0,34 CuL 90Ω 58H	Rel Bv 621 H 3072
L 3,4	2	(Zub tr M 42a) Wicklg. I (2,3) 324 Wdg 0,60 CuL 1,76Ω 32mH	Rel Bv 621 E 3249
		Schichtdrehwiderstand LAYER-TYPE VAR RESISTOR	
P 14,15,16	3	100kΩ +20/-30%; 0,2W	100 kΩ lin Rel TL 613 C 3004a3
R 7	1	200kΩ +20/-30%; 0,1W	200 kΩ lin Rel TL 613 C 3005a1

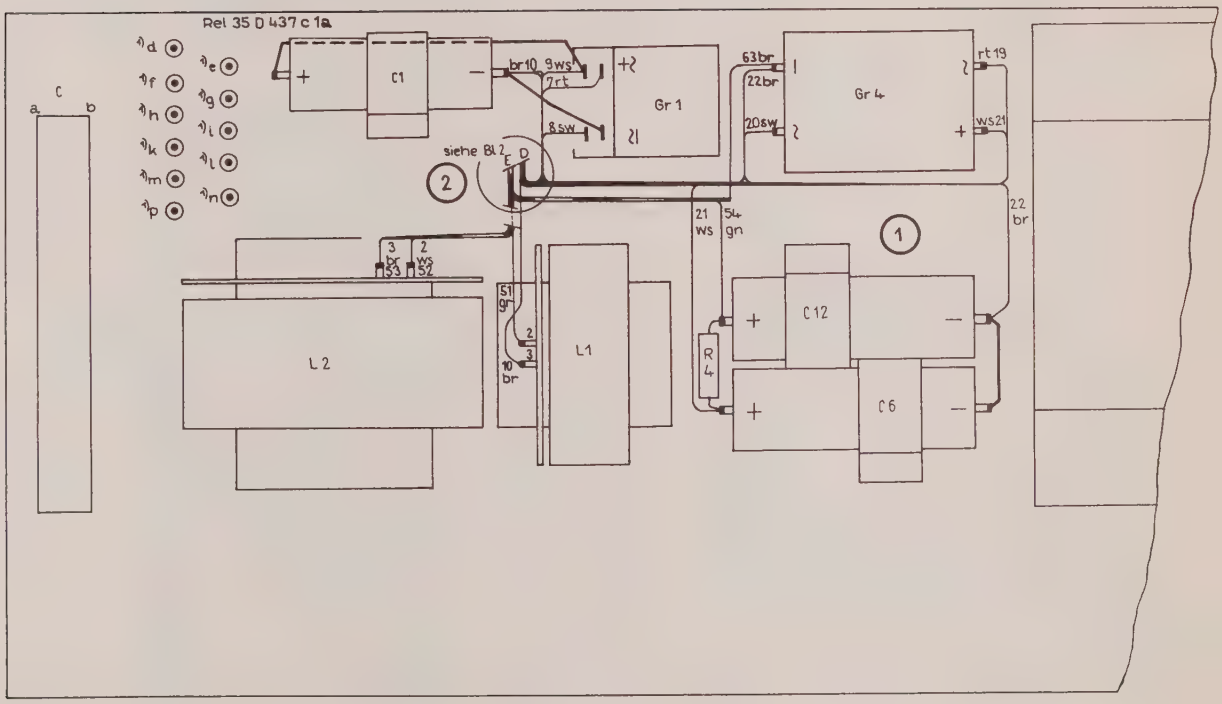
		Schichtwiderstand LAYER-TYPE RESISTOR	
R 1	1	1,5MΩ ±5%; 0,33W	B 51264 A 1,5 M 5/2
R 2	1	1,5kΩ ±5%; 0,25W	B51263-A2152-M
R 3,19	2	2MΩ ±5%; 0,33W	B 51264 A 1 M 5/2
R 4	1	2kΩ ±5%; 1W	B 51266 A 2 K 5/2
R 5	1	400kΩ ±5%; 0,33W	B 51264 A 400 K 5/2
R 6	1	600kΩ ±5%; 0,33W	B 51264 A 600 K 5/2
R 8	1	800kΩ ±5%; 0,33W	B 51264 A 800 K 5/2
R 9	1	50kΩ ±5%; 1W	B 51266 A 50 K 5/2
R 12,13 14,15	4	100kΩ ±10%; 0,33W	B51263-A4104-K
R 20	1	50kΩ ±10%; 0,33W	B 51264 A 50 K 10/5
S 3	1	Netzschalter POWER SWITCH 250V / 6A	Rel sch 171a
S 4	1	Spannungswähler VOLTAGE ADJUSTER	Rel sch 268a
Tr	1	Netztransformator POWER TRANSFORMER	Rel Bv 621 L 3116
		Wicklg. I (1a,2a,3a) 44 Wdg 0,80 CuL 0,27Ω 1. Abgriff (2a): 22 Wdg	
		Wicklg. II (3a,5a) 242 Wdg 0,60 CuL 2,5Ω	
		Wicklg. III (4a,6a) 242 Wdg 0,60 CuL 2,8Ω	
		Wicklg. IV (8c,1d) 745 Wdg 0,10 CuL 365Ω	
		Wicklg. V (2d,3d) 164 Wdg 0,10 CuL 90Ω	
		Wicklg. VI (4d,5d) 500 Wdg 0,25 CuL 38Ω	
		Wicklg. VII (7d,6d) 251 Wdg 0,25 CuL 16Ω	
		Wicklg. VIII (9d,8d) 39 Wdg 0,37 CuL 1,6Ω	
		Wicklg. IX (1b,6b) 15 Wdg 3x1,10 CuL paral. 0,03Ω	
		Wicklg. X (1c,2c) 22 Wdg 0,65 CuL 0,3Ω	
		Wicklg. XI (6c,7c) 15 Wdg 0,80 CuL 0,15Ω	

Wicklg. XII (5c,4c,3c)
48 Wdg 0,50 CuL 1,2Ω
1. Abgriff (4c): 24 Wdg

Wicklg. XIII (2b,3b)
84 Wdg 0,37 CuL 3,8Ω

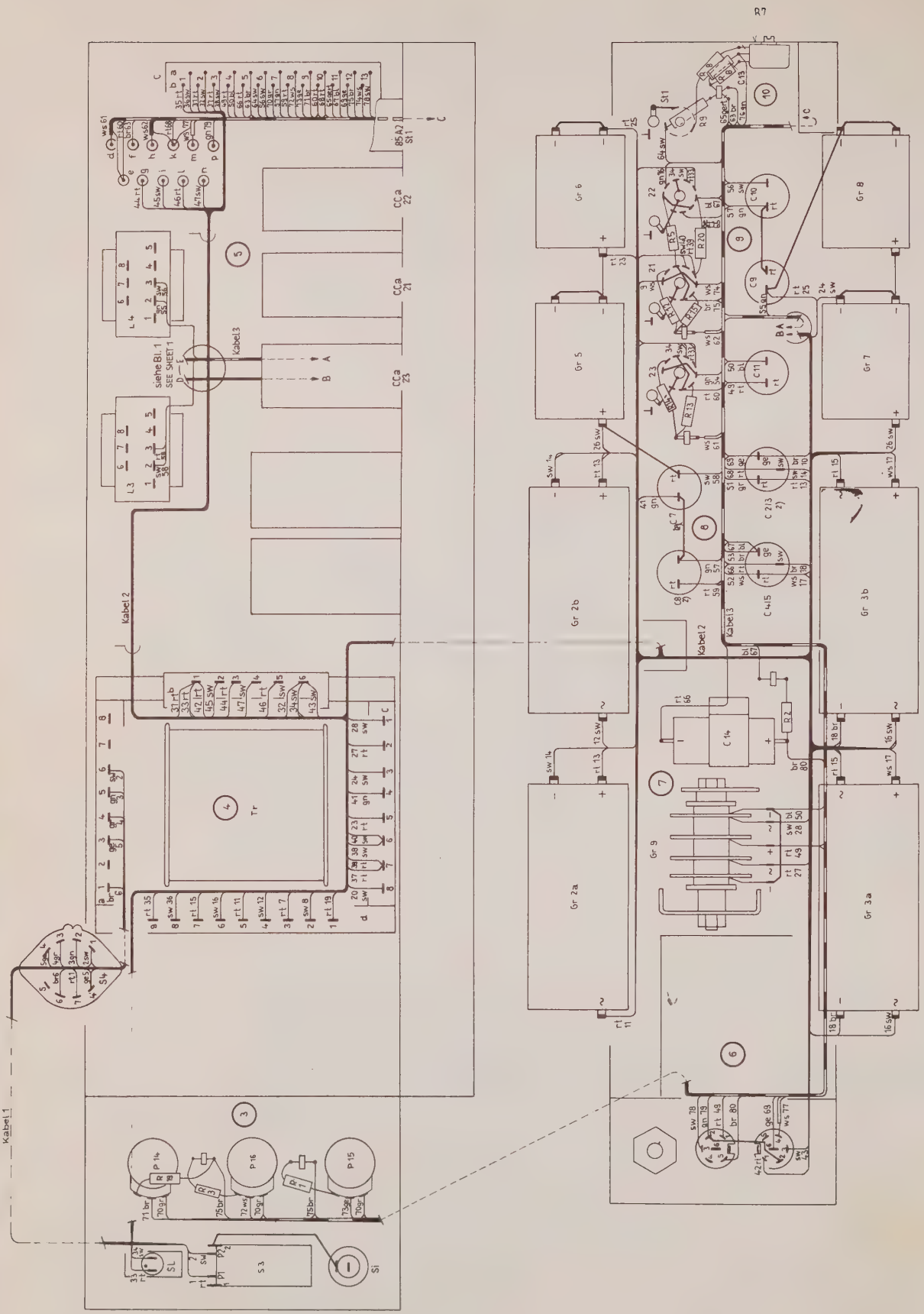
Wicklg. XIV (4b,5b)
84 Wdg 0,37 CuL 3,8Ω

1	Netzanschlußleitung POWER CORD	Rel ltg 702e



Netzteil
POWER SUPPLY UNIT

Rel ms 35 D 437c1a Bl. 1 (Ausgabe I)
Rel ms 35 D 437c1a SHEET 1 (ISSUE I)

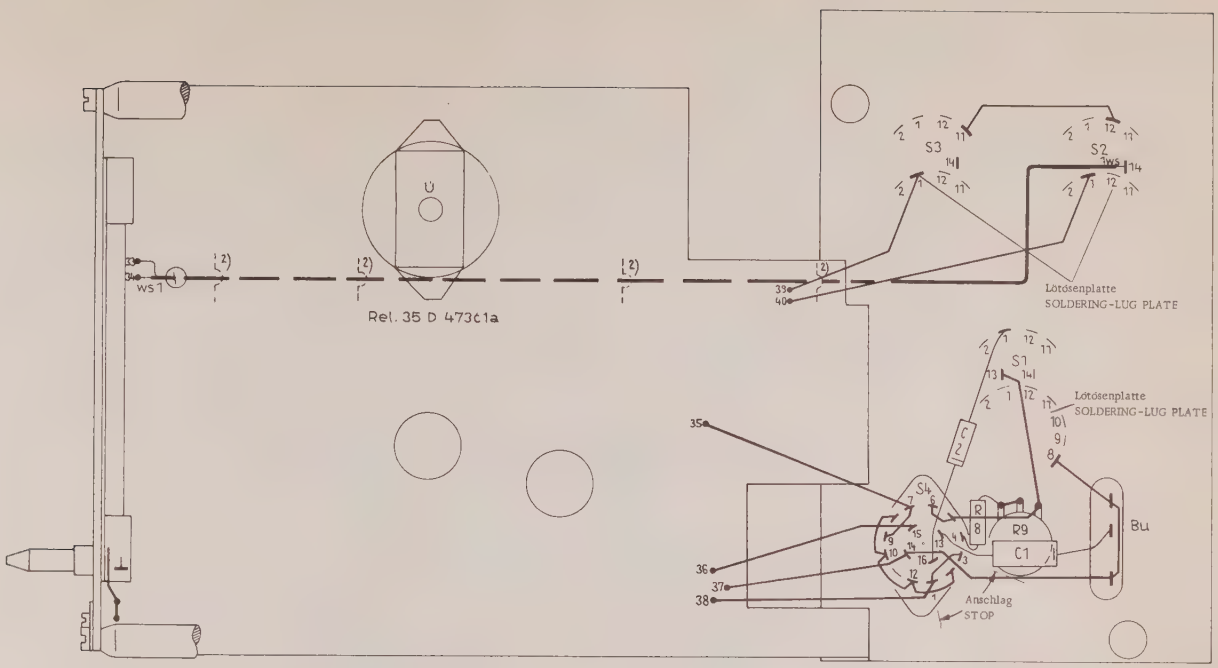


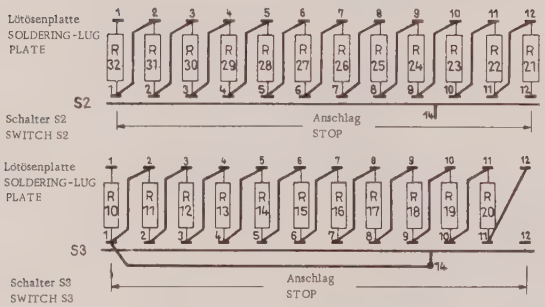
Netzteil
POWER SUPPLY UNIT

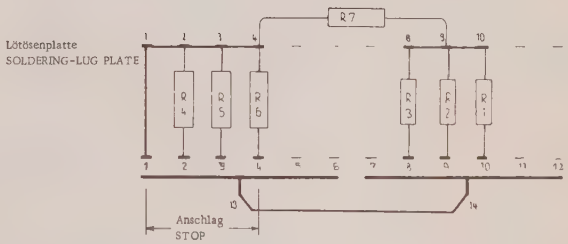
Rel ms 35 D 437c1a Bl. 2 (Ausgabe I)
Rel ms 35 D 437c1a SHEET 2 (ISSUE I)

	Ausfg. MODEL 1a,2a			
	1	1	ZF-Verstärkerplatte IF-AMPLIFIER BOARD	Rel Sk 35 D 473c1a 5-28
C 1	1	1	MKH-Kondensator MKH-CAPACITOR 0,047µF ±20%; 300V-	B32220-A3473-M
C 2	1	1	Styroflex-Kondensator STYROFLEX CAPACITOR 1000pF ±5%; 125V-	B31140-A1102-J
			Schichtwiderstand LAYER-TYPE RESISTOR	
R 1	1	-	57kΩ ±5%; 0,25W	B51263-A2573-J
	-	1	50kΩ ±5%; 0,25W	B51263-A2503-J
R 2	1	-	81,5kΩ ±5%; 0,25W	B51263-A2813-J500
	-	1	70kΩ ±5%; 0,25W	B51263-A2703-J
R 3	1	-	155kΩ ±5%; 0,25W	B51263-A2154-J500
	-	1	136kΩ ±5%; 0,25W	B51263-A2134-J600
R 4	1	-	1,554kΩ ±0,5%; 0,15W	B 51264 A 1,554 K 0,5/0,5
	-	1	1,803kΩ ±0,5%; 0,15W	B 51264 A 1,803 K 0,5/0,5
R 5	1	-	3,272kΩ ±0,5%; 0,15W	B 51264 A 3,272 K 0,5/0,5
	-	1	3,826kΩ ±0,5%; 0,15W	B 51264 A 3,826 K 0,5/0,5
R 6	1	-	5,170kΩ ±0,5%; 0,15W	B 51264 A 5,170 K 0,5/0,5
	-	1	6,098kΩ ±0,5%; 0,15W	B 51264 A 6,098 K 0,5/0,5
R 7	1	1	15kΩ ±0,5%; 0,15W	B 51264 A 15 K 0,5/0,5
R 8	1	1	20kΩ ±5%; 0,25W	B51263-A2203-J
R 10	1	-	3,3kΩ ±1%; 0,1W	B51263-A9332-F
	-	1	3kΩ ±1%; 0,1W	B51263-A9302-F
R 11-20	10	-	143Ω ±1%; 0,1W	B51263-A9141-F300
	-	10	174Ω ±1%; 0,1W	B51263-A9171-F400
			Metallschichtwiderstand METALLIZED LAYER-TYPE RESISTOR	
R 21	1	-	951,6Ω ±0,2%; 0,15W	B54992-A9951-C162
	-	1	1,087kΩ ±0,2%; 0,15W	B54992-A9102-C872
R 22	1	-	861,0Ω ±0,2%; 0,15W	B54992-A9861-C102
	-	1	969,2Ω ±0,2%; 0,15W	B54992-A9961-C922

	1a,2a			
			Metallschichtwiderstand METALLIZED LAYER-TYPE RESISTOR	
R 23	1	-	779,2Ω ±0,2%; 0,15W	B54992-A9771-C922
	-	1	863,8Ω ±0,2%; 0,15W	B54992-A9861-C382
R 24	1	-	705,0Ω ±0,2%; 0,15W	B54992-A9701-C502
	-	1	769,9Ω ±0,2%; 0,15W	B54992-A9761-C992
C 25	1	-	637,9Ω ±0,2%; 0,15W	B54992-A9631-C792
	-	1	686,2Ω ±0,2%; 0,15W	B54992-A9681-C622
R 26	1	-	577,2Ω ±0,2%; 0,15W	B54992-A9571-C722
	-	1	611,6Ω ±0,2%; 0,15W	B54992-A9611-C162
R 27	1	-	522,3Ω ±0,2%; 0,15W	B54992-A9521-C232
	-	1	545,0Ω ±0,2%; 0,15W	B54992-A9541-C502
R 28	1	-	472,6Ω ±0,2%; 0,15W	B54992-A9471-C262
	-	1	485,8Ω ±0,2%; 0,15W	B54992-A9481-C582
R 29	1	-	427,6Ω ±0,2%; 0,15W	B54992-A9421-C762
	-	1	432,9Ω ±0,2%; 0,15W	B54992-A9431-C292
R 30	1	-	386,9Ω ±0,2%; 0,15W	B54992-A9381-C692
	-	1	385,9Ω ±0,2%; 0,15W	B54992-A9381-C592
R 31	1	-	350,1Ω ±0,2%; 0,15W	B54992-A9351-C012
	-	1	343,9Ω ±0,2%; 0,15W	B54992-A9341-C392
R 32	1	-	3,329kΩ ±0,2%; 0,15W	B54992-A9332-C292
	-	1	2,818kΩ ±0,2%; 0,15W	V54992-A9282-C182
R 9	1	1	Schichtdrehwiderstand LAYER-TYPE VAR RESISTOR 100kΩ / 0,1W	100 kΩ lin Rel TL 613 C 3005a2
			Drehschalter ROTARY SWITCH	
S 1	1	1	2polig; 1 Ebene; 12 Stellungen 2-POLE; 1-DECK; 12-POSITIONS	Rel sch 176 Form B
S 2,3	2	2	1polig; 1 Ebene; 12 Stellungen 1-POLE; 1-DECK; 12-POSITIONS	Rel sch 304a Form B
S 4	1	1	4polig; 2 Ebene; 3 Stellungen 4-POLE; 2-DECK; 3 POSITIONS	Rel sch 304a Form B







ZF-Verstärker — Rel ms 3 D 916(c1a)c2a (Ausgabe II)
IF AMPLIFIER — Rel ms 3 D 916(c1a)c2a (ISSUE II)

		Elektrolyt-Kondensator ELECTROLYTIC CAPACITOR	
C 1,5	1	25+25µF +50/-10%; 350V-	B 43298 A 25+25/350
C 7	1	25µF +50/-20%; 6V-	B41951-B2256-S
C 8	1	8µF +50/-10%; 150V-	B43711-A1805-T
		MKH-Kondensator MKH-CAPACITOR	
C 2,6	2	0,047µF ±20%; 300V-	B32220-A3473-M
C 3	1	0,1µF ±20%; 300V-	B32220-A3104-M
		Styroflex-Kondensator STYROFLEX CAPACITOR	
C 4	1	50pF ±1%; 125V-	B31140-A1500-F
C 9,10	2	15000pF ±2%; 125V-	B31143-A1153-G
C 11	1	2000pF ±5%; 125V-	B31141-A1202-J
C 12,13	2	4000pF ±5%; 125V-	B31142-A1402-J
C 14	1	2000pF ±5%; 125V-	B31140-A1202-J
C 15	1	800pF ±5%; 125V-	B31140-A1801-J
C 16	1	340pF ±5%; 125V-	B31140-A1341-J
		Germanium-Diode GERMANIUM DIODE	
Gr 1-4	4	J_D = 50mA; U_{Sp} = 100V-	AAY 25
Gr 5	1	J_D = 200mA; U_{Sp} = 100V-	OA 5
		Schichtwiderstand LAYER-TYPE RESISTOR	
R 1,7,14	3	1MΩ ±5%; 0,33W	B 51264 A 1 M 5/2
R 2,13,16 6	4	1kΩ ±5%; 0,25W	B51263-A2102-J
R 3,12	2	500kΩ ±5%; 0,33W	B 51264 A 500 K 5/2
R 4	1	3kΩ ±0,5%; 0,15W	B 51264 A 3 K 0,5/0,5
R 5	1	5kΩ ±5%; 0,25W	B51263-A2502-J
R 8	1	6kΩ ±0,5%; 0,15W	B 51264 A 6 K 0,5/0,5
R 9	1	20kΩ ±0,5%; 0,15W	B 51264 A 20 K 0,5/0,5
R 10	1	500Ω ±5%; 0,25W	B51263-A2501-J
R 11,20,21 22,23	5	10kΩ ±5%; 0,25W	B51263-A2103-J
R 15,18	2	100Ω ±5%; 0,25W	B51263-A2101-J
R 17	1	40Ω ±5%; 0,25W	B51263-A2400-J

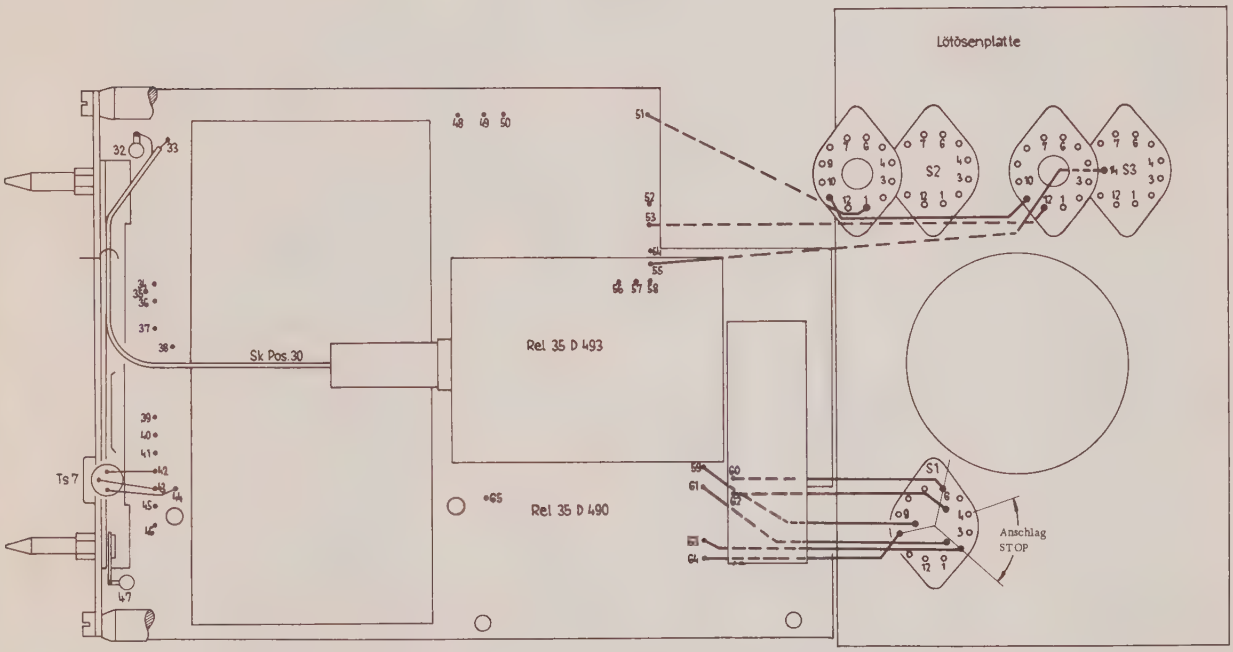
		Schichtwiderstand LAYER-TYPE RESISTOR	
R 19	1	1kΩ ±5%; 0,5W	B 51265 A 1 K 5/2
R 24,25	2	50kΩ ±5%; 0,25W	B51263-A2503-J
R 26,27,28	3	100kΩ ±5%; 0,25W	B51263-A2104-J
R 29,30	2	250kΩ ±5%; 0,25W	B51263-A2254-J
R 31,32	2	600kΩ ±5%; 0,33W	B 51264 A 600 K 5/2
R 35	1	13kΩ ±5%; 0,25W	B51263-A2133-J
R 37	1	1kΩ ±5%; 0,25W	B51263-A2102-J
R 38	1	3,5kΩ ±5%; 0,25W	B51263-A2352-J
		Schichtdrehwiderstand LAYER-TYPE VAR RESISTOR	
R 34	1	1kΩ +20/-30%; 0,1W	1 kΩ lin Rel wd 146d
R 36	1	10kΩ +20/-30%; 0,1W	10 kΩ lin Rel wd 146d
Ts 1	1	Transistor TRANSISTOR	ASY 11
Ü	1	Übertrager TRANSFORMER (Rel sp 78b) Wicklg. I (1,4) 505 Wdg 0,12 CuL 58Ω 147,5....163,5mH Wicklg. II (2,4) 505 Wdg 0,12 CuL 58Ω Induktivität II=I ±3mH ÜI/II = 1 ±1% Wicklg. III (7,8) 706 Wdg 0,15 CuL 60Ω ÜIII/I = 1,4 ±3%	Rel Bv 622 U 3020

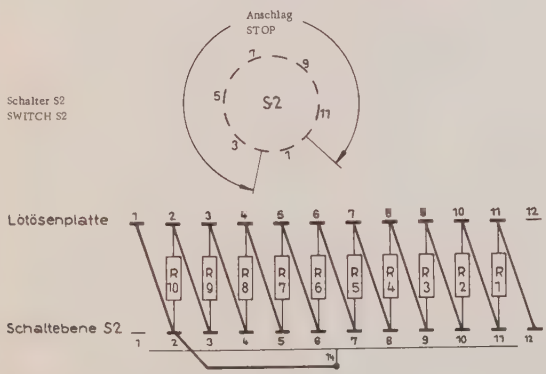
ZF-Verstärkerplatte
IF AMPLIFIER BOARD

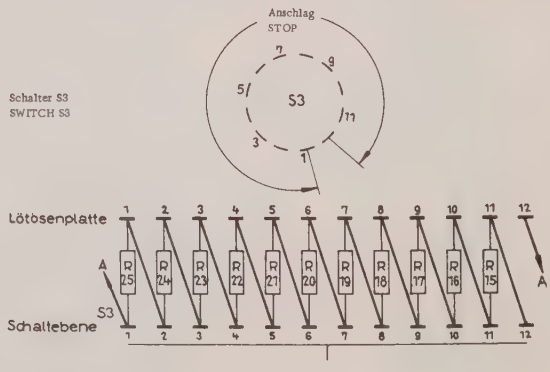
Rel ms 35 D 473c1a (Ausgabe I)
Rel ms 35 D 473c1a (ISSUE I)

	Ausfg. MODEL 1a,2a,3a				
	1	1	1	Verstärkerplatte AMPLIFIER BOARD	Rel Sk 35 D 490b1a, 2a,3a 5-33
	1	1	1	Eichleitung ATTENUATOR	Rel Sk 35 D 493c 1a, 2a 5-37
				Schichtwiderstand LAYER-TYPE RESISTOR	
R 1-10	10	-	-	137Ω ±1%; 0,1W	B51263-A9131-F700
R 1-10	-	10	10	167Ω ±1%; 0,1W	
				Metallschichtwiderstand METALLIZED LAYER-TYPE RESISTOR	
R 15	1	-	-	951,6Ω ±0,2%; 0,15W	B54992-A9951-C162
	-	1	1	1,087kΩ ±0,2%; 0,15W	B54992-A9102-C872
R 16	1	-	-	861,0Ω ±0,2%; 0,15W	B54992-A9861-C102
	-	1	1	969,2Ω ±0,2%; 0,15W	B54992-A9961-C922
R 17	1	-	-	779,2Ω ±0,2%; 0,15W	B54992-A9771-C922
	-	1	1	863,8Ω ±0,2%; 0,15W	B54992-A9861-C382
R 18	1	-	-	705,0Ω ±0,2%; 0,15W	B54992-A9701-C502
	-	1	1	769,9Ω ±0,2%; 0,15W	B54992-A9761-C992
R 19	1	-	-	637,9Ω ±0,2%; 0,15W	B54992-A9631-C792
	-	1	1	686,2Ω ±0,2%; 0,15W	B54992-A9681-C622
R 20	1	-	-	577,2Ω ±0,2%; 0,15W	B54992-A9571-C722
	-	1	1	611,6Ω ±0,2%; 0,15W	B54992-A9611-C162
R 21	1	-	-	522,3Ω ±0,2%; 0,15W	B54992-A9521-C232
	-	1	1	545,0Ω ±0,2%; 0,15W	B54992-A9541-C502
R 22	1	-	-	472,6Ω ±0,2%; 0,15W	B54992-A9471-C262
	-	1	1	485,8Ω ±0,2%; 0,15W	B54992-A9481-C582
R 23	1	-	-	427,6Ω ±0,2%; 0,15W	B54992-A9421-C762
	-	1	1	432,9Ω ±0,2%; 0,15W	B54992-A9431-C292
R 24	1	-	-	386,9Ω ±0,2%; 0,15W	B54992-A9381-C692
	-	1	1	385,9Ω ±0,2%; 0,15W	B54992-A9381-C592
R 25	1	-	-	350,1Ω ±0,2%; 0,15W	B54992-A9351-C012
	-	1	1	343,9Ω ±0,2%; 0,15W	B54992-A9341-C392

	1a	2a	3a		
				Drehschalter ROTARY SWITCH	
S 1	1	1	1	3polig; 1 Ebene; 2 Stellungen 3-POLE; 1 DECK; 2-POSITIONS	Rel sch 303a Form N
S 2,3	2	2	2	1polig; 1 Ebene; 12 Stellungen 1-POLE; 1-DECK; 12-POSITIONS	Rel sch 175 f Form B
Ts 7	1	1	1	Transistor TRANSISTOR	ADY 12





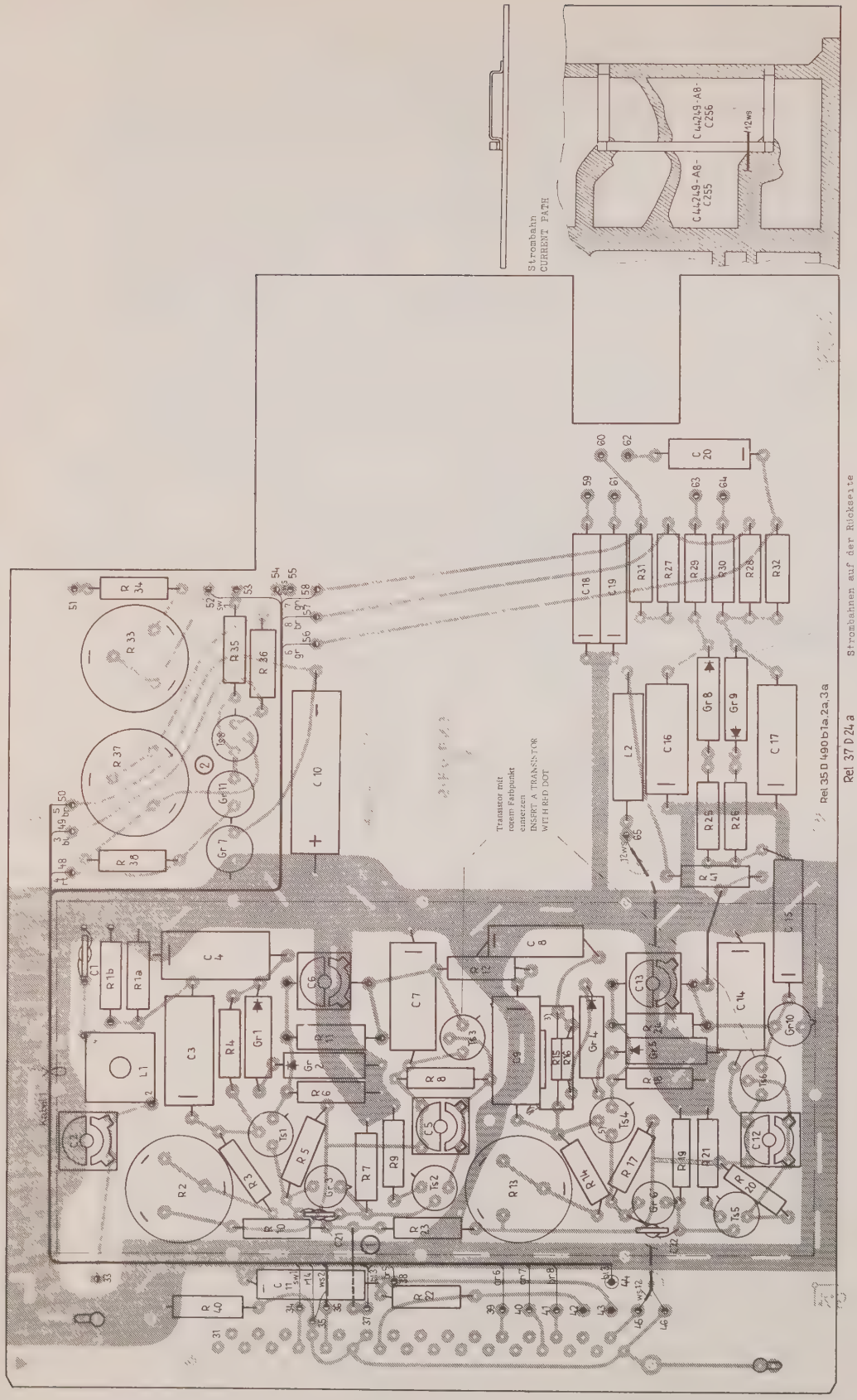


Breitbandverstärker 10 kHz bis 17 MHz — Rel ms 3 D 917 (b1a)b2a, 3a (Ausgabe III)
WIDEBAND AMPLIFIER 10 kHz TO 17 MHz — Rel ms 3 D 917 (b1a)b2a, 3a (ISSUE III)

	Ausfg. MODEL 1a	2a	3a		
				Keramik-Kondensator CERAMIC CAPACITOR	
C 1	1	1	1	10pF ±1pF; 500V-	B 38218 N 033 A 10 F
C 21,22	2	2	2	8000pF +30/-20%; 500V-	B37636-B5802-R001
				Lufttrimmer AIR-DIELECTRIC TRIMMER	
C 2,5,12	3	3	3	1,9-11,0pF 250V-	Rel ko 131f
C 6,13	2	2	2	1,3-5,0pF 250V-	Rel ko 131c
				MKL-Kondensator MKL-CAPACITOR	
C 3,4,7 9,14	5	5	5	1µF ±20%; 50V-	B32110-C9105-M
C 8	1	1	1	0,15µF ±20%; 50V-	B32110-C9154-M
C 11	1	1	1	0,22µF ±20%; 50V-	B32110-C9224-M
C 15	1	1	1	0,22µF ±20%; 250V-	B32110-C2224-M
C 10	1	1	1	Elektrolyt-Kondensator ELECTROLYTIC CAPACITOR 25µF +50/-20%; 35V-	B41951-B7256-S
				Styroflex-Kondensator STYROFLEX CAPACITOR	
C 16,17	2	2	2	3000pF ±2%; 250V-	B31142-A2302-G
C 20	1	1	1	200pF ±5%; 500V-	B31141-A5201-J
C 18,19	2	2	2	MKH-Kondensator MKH-CAPACITOR 0,01µF ±20%; 300V-	B32220-A3103-M
				Richtleiter CRYSTAL DIODE	
Gr 1,2 4,5	4	4	4	J_D = 75mA; U_{Sp} = 25V-	AAY 26
Gr 8,9	2	2	2	J_D = 6mA; U_{Sp} = 15V-	OA 160
Gr 10,11	2	2	2	J_D = 200mA; U_{SP} = 100V-	OA 5 (Fa. Valvo)
				Zenerdiode ZENER DIODE	
Gr 3,6	2	2	2	J_Z = 5mA; U_Z = 7-8V-	Z7 (Fa. Intermetall)
Gr 7	1	1	1	J_Z = 5mA; U_Z= 18V-; R_Z= 110Ω	SZ 18 K St

	1a	2a	3a		
				Spule COIL	
L 1	1	1	1	Wicklg. I (2,4) 3 Wdg 0,80 CuL 4Ω 80-115nH	Rel Bv 623 M 3049
	1	1	1	Wicklg. I (2,4) 2 Wdg 0,80 CuL 3Ω 56-74nH	Rel Bv 623 M 3050
	1	1	1	Wicklg. I (2,4) 4 Wdg 0,80 CuL 5Ω 100-165nH	Rel Bv 623 M 3051
L 2	1	1	1	UKW-Drossel UHF CHOKE 1A / 10µH	B 82501-A-C15
				Metallschichtwiderstand METALLIZED LAYER-TYPE RESISTOR	
R 1a	1	1	1	170Ω ±1%; 0,15W	MLAD-HF 0,15 W TK 50 1% 170 Ω (Fa. Stemag)
R 35	1	-	-	3,329kΩ ±0,2%; 0,25W	AT. E 1/4-3,329 K-0,2% (Fa.Elettronica,Metal-Lux)
	-	1	1	2,818kΩ ±0,2%; 0,25W	AT. E. 1/4-2,818 K-0,2% (Fa.Elettronica Metal-Lux)
				Schichtdrehwiderstand LAYER-TYPE VAR RESISTOR	
R 2,37	2	2	2	10kΩ lin 0,1W	10 kΩ lin Rel wd 146d
R 13	1	1	1	20kΩ lin 0,1W	20 kΩ lin Rel wd 146d
R 33	1	1	1	1kΩ lin 0,1W	1 kΩ lin Rel wd 146d
				Schichtwiderstand LAYER-TYPE RESISTOR	
R 1b	1	1	1	1,5kΩ ±1%; 0,1W	B51263-A9152-F
R 3	1	1	1	4kΩ ±1%; 0,1W	B51263-A9402-F
R 4	1	1	1	150Ω ±1%; 0,1W	B51263-A9151-F
R 5,17,22	3	3	3	1,5kΩ ±5%; 0,15W	B51263-A2152-J
R 16,18	2	2	2	50Ω ±1%; 0,1W	B51263-A9500-F
R 7,19	2	2	2	1,2kΩ ±5%; 0,25W	B51263-A2122-J
R 8,20	2	2	2	1kΩ ±5%; 0,25W	B51263-A2102-J
R 9,21	2	2	2	50Ω ±5%; 0,25W	B51263-A2500-J
R 10,23	2	2	2	15Ω ±5%; 0,25W	B51263-A2150-J
R 11,24	2	2	-	920Ω ±1%; 0,1W	B51263-A9921-F
	-	-	2	860Ω ±1%; 0,1W	B51263-A9861-F
R 12	1	1	1	60Ω ±5%; 0,25W	B51263-A2600-J
R 14,41	2	2	2	10kΩ ±5%; 0,25W	B51263-A2103-J

	1a	2a	3a		
				Schichtwiderstand LAYER-TYPE RESISTOR	
R 15	1	1	1	300Ω ±5%; 0,25W	B51263-A2301-J
R 16	1	1	1	400Ω ±5%; 0,25W	B51263-A2401-J
R 25,26	2	2	2	100Ω ±1%; 0,1W	B51263-A9101-F
R 27,28	2	2	2	40kΩ ±1%; 0,1W	B51263-A9403-F
R 29,30	2	2	2	25Ω ±5%; 0,25W	B51263-A2250-J
R 31,32	2	2	2	200kΩ ±5%; 0,25W	B51263-A2204-J
R 34	1	-	-	3,3kΩ ±1%; 0,1W	B51263-A9332-F
	-	1	1	3kΩ ±1%; 0,1W	B51263-A9303-F
R 36	1	1	1	8kΩ ±5%; 0,25W	B51263-A2802-J
R 38	1	1	1	2kΩ ±5%; 0,25W	B51263-A2202-J
R 40	1	1	1	5Ω ±5%; 0,33W	B51263 A 5 Ω 5/2
Ts 1-6	6	6	6	Mesa-Transistor MESA-TRANSISTOR	2 N 1143 (Fa. Texas)
Ts 8	1	1	1	Transistor TRANSISTOR	ASY 11

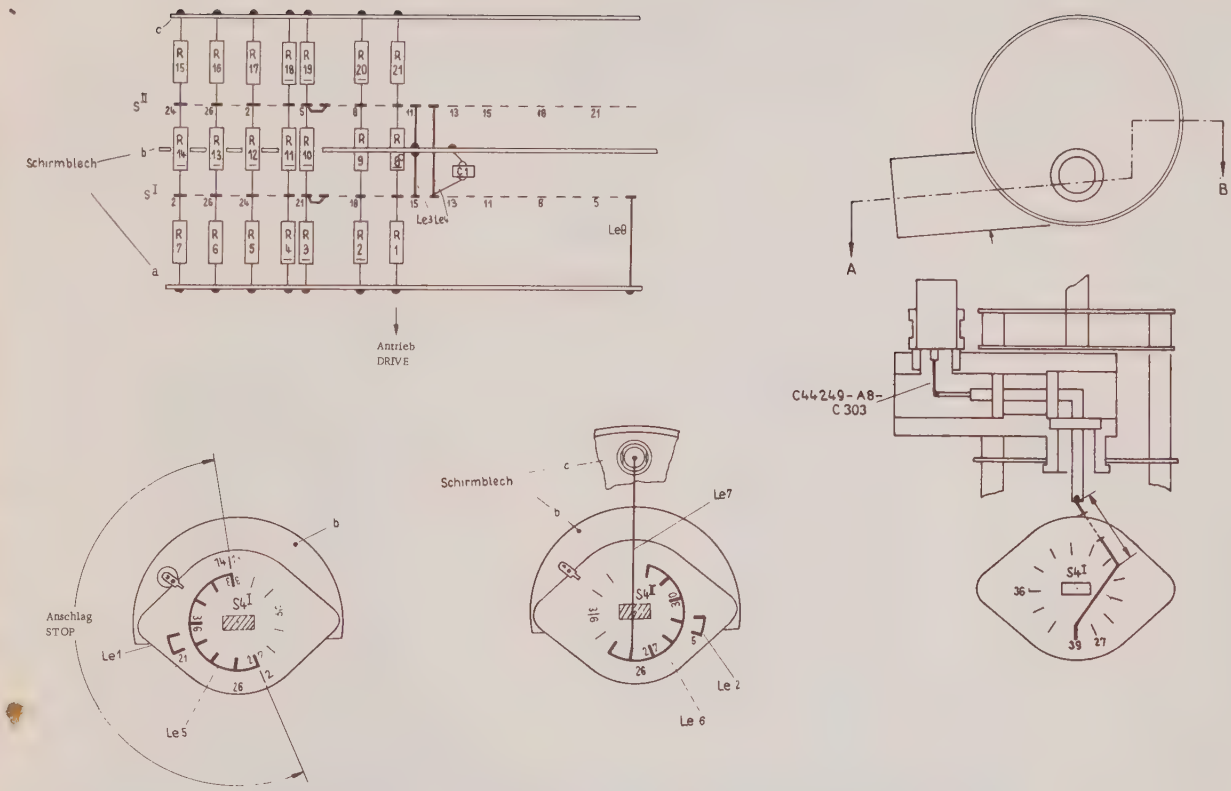


Verstärkerplatte
AMPLIFIER BOARD

Rel ms 35 D 490b1a, 2a, 3a (Ausgabe III)
Rel ms 35 D 490b1a, 2a, 3a (ISSUE III)

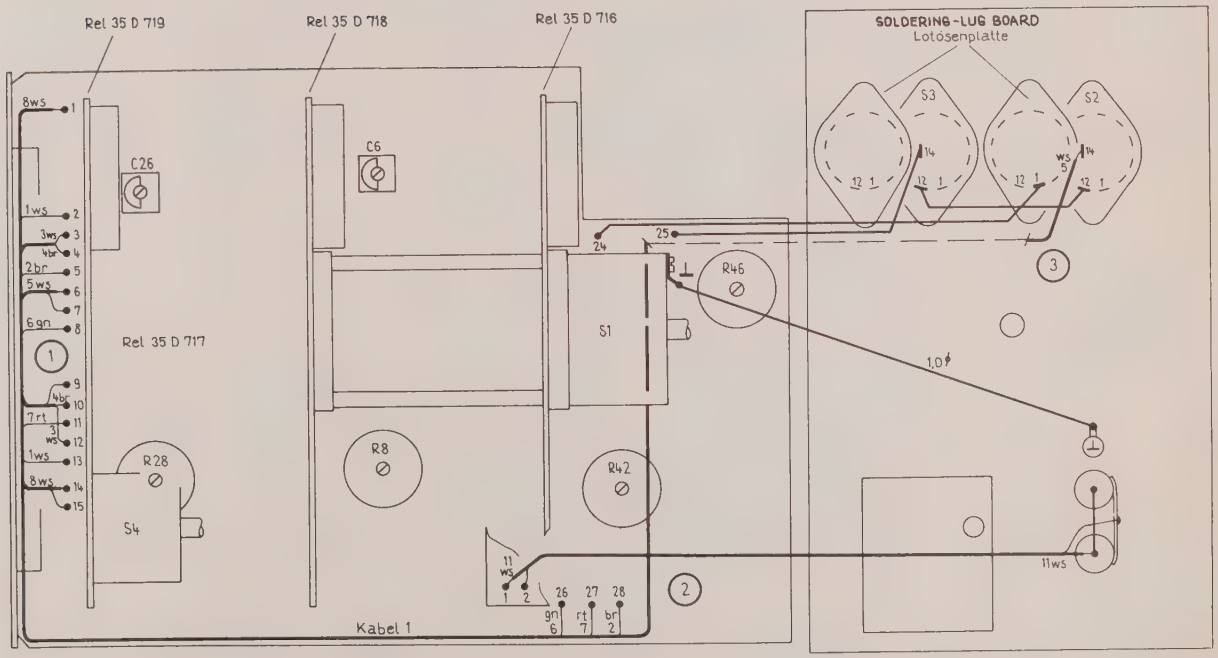
	Ausfg. MODEL 1a	2a		
C 1	1	1	Keramik-Kondensator CERAMIC CAPACITOR 3,2pF ±0,25pF 500V-	B 38215 N 075 A 3,2 C
			Metallschichtwiderstand METALLIZED LAYER-TYPE RESISTOR	
R 1,21	2	-	306,22Ω ±0,2%; 1/4W	AFL.AW-1/4-306,33-0,2 %
	-	2	267,76Ω ±0,2%; 1/4W	AFL.AW-1/4-267,76-0,2 %
R 2	1	-	162,3Ω ±0,2%; 1/4W	AFL.AW-1/4-162,3-0,2 %
	-	1	144,5Ω ±0,2%; 1/4W	AFL.AW-1/4-144,5-0,2 %
R 3	1	-	118,08Ω ±0,2%; 1/4W	AFL.AW-1/4-118,08-0,2 %
	-	1	107,44Ω ±0,2%; 1/4W	AFL.AW-1/4-107,44-0,2 %
R 4,18	2	-	98,48Ω ±0,2%; 1/4W	AFL.AW-1/4-98,48-0,2 %
	-	2	91,65Ω ±0,2%; 1/4W	AFL.AW-1/4-91,65-0,2 %
R 5,17	2	-	88,41Ω ±0,2%; 1/4W	AFL-AW-1/4-88,41-0,2 %
	-	2	83,94Ω ±0,2%; 1/4W	AFL.AW-1/4-83,94-0,2 %
R 6,16	2	-	82,86Ω ±0,2%; 1/4W	AFL.AW-1/4-82,86-0,2 %
	-	2	79,87Ω ±0,2%; 1/4W	AFL.AW-1/4-79,87-0,2 %
R 7,15	2	-	79,67Ω ±0,2%; 1/4W	AFL.AW-1/4-79,67-0,2 %
	-	2	77,72Ω ±0,2%; 1/4W	AFL.AW-1/4-77,72-0,2 %
R 8	1	-	39,08Ω ±0,2%; 1/4W	AFL.AW-1/4-39,08-0,2 %
	-	1	45,59Ω ±0,2%; 1/4W	AFL.AW-1/4-45,59-0,2 %
R 9	1	-	88,14Ω ±0,2%; 1/4W	AFL.AW-1/4-88,14-0,2 %
	-	1	106,6Ω ±0,2%; 1/4W	AFL.AW-1/4-106,6-0,2 %
R 10	1	-	159,7Ω ±0,2%; 1/4W	AFL.AW-1/4-159,7-0,2 %
	-	1	204,2Ω ±0,2%; 1/4W	AFL.AW-1/4-204,2-0,2 %
R 11	1	-	272,0Ω ±0,2%; 1/4W	AFL.AW-1/4-272,0-0,2 %
	-	1	371Ω ±0,2%; 1/4W	AFL.AW-1/4-371-0,2 %
R 12	1	-	453,8Ω ±0,2%; 1/4W	AFL.AW-1/4-453,8-0,2 %
	-	1	664,73Ω ±0,2%; 1/4W	AFL.AW-1/4-664,73-0,2 %
R 13	1	-	751,3Ω ±0,2%; 1/8W	AFL.AW-1/8-751,3-0,2 %
	-	1	1183Ω ±0,2%; 1/8W	AFL.AW-1/8-1183-0,2 %
R 14	1	-	1240,7Ω ±0,2%; 1/8W	AFL.AW-1/8-1240,7-0,2 %
	-	1	2108Ω ±0,2%; 1/8W	AFL.AW-1/8-2108-0,2 %
R 19	1	-	118,08Ω ±0,2%; 1/4W	AFL.AW-1/4-118,08-0,2 %
	-	1	107,44Ω ±0,2%; 1/4W	AFL.AW-1/4-107,44-0,2 %
R 20	1	-	162,3Ω ±0,2%; 1/4W	AFL.AW 1/4-162,3-0,2 %
	-	1	144,5Ω ±0,2%; 1/4W	AFL.AW-1/4-144,5-0,2 %

+Fa. Elelltronica Metal-Lux



Eichleitung 0 bis 35 dB/0 bis 3,5 Np Rel ms 35 D 493c1a, 2a (Ausgabe I)
ATTENUATOR 0 TO 35 dB/0 TO 3,5 Np Rel ms 35 D 493c1a, 2a (ISSUE I)

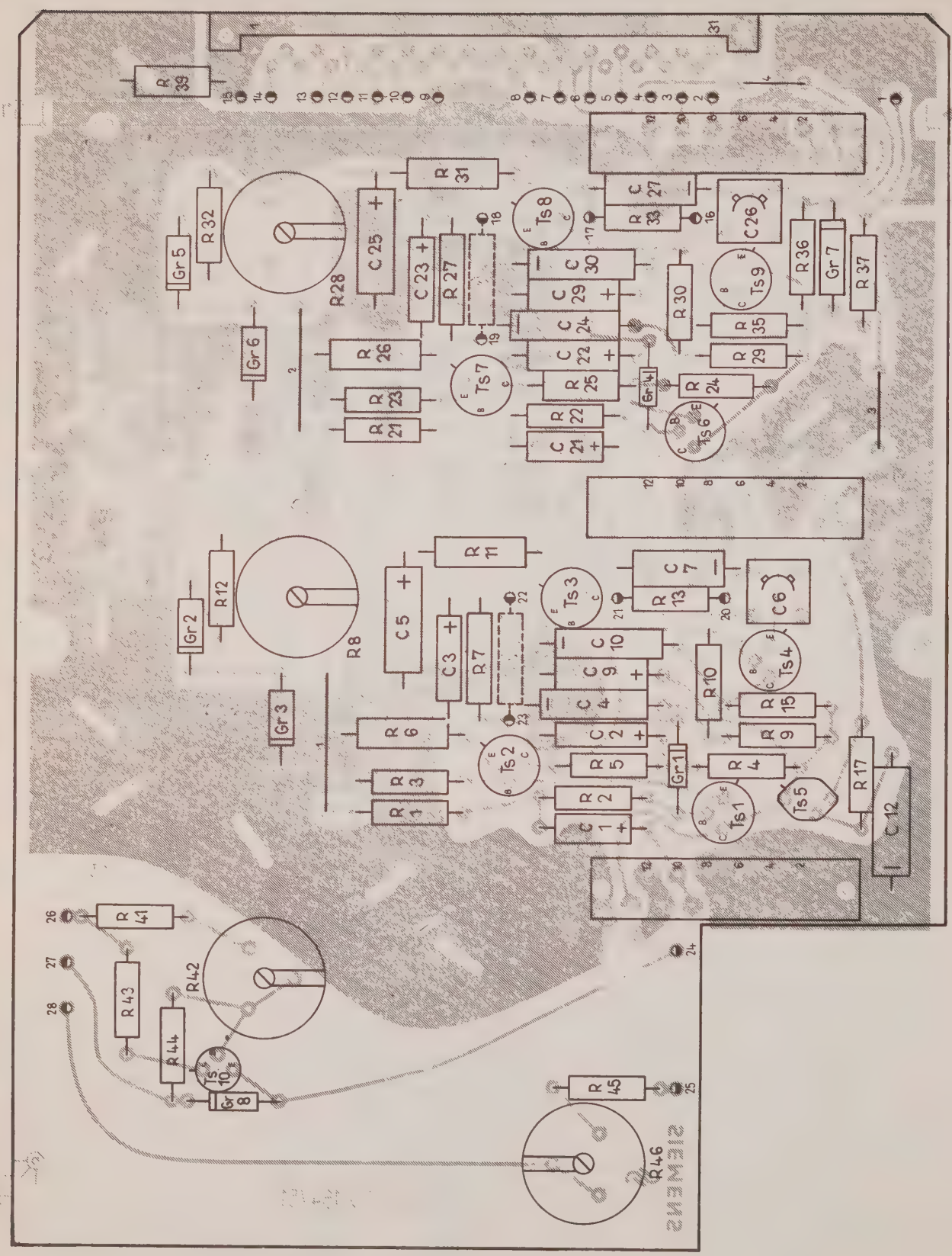
1a (Np)	2a (dB)			
1	1	Verstärkerstufe 1 und 2 AMPLIFIER STAGES 1 AND 2	Rel Sk 35 D 717a 1a,2a	5-40
1	1	Meßgleichrichter MEASURING DEMODULATOR	Rel Sk 35 D 719a1a	5-43
1	1	Schalterbaugruppe SWITCH SUBASSEMBLY	Rel Sk 35 D 720a 1a,2a	5-44
		Meßlinienteiler MEASURING-LINE DIVIDER		
1	1	0,1 Np / 1 dB	Rel Sk 35 D 728a 1a,2a	5-48
1	1	0,01 Np / 0,1 dB	Rel Sk 35 D 729a 1a,2a	5-49



Breitbandverstärker 0,2 bis 1600 kHz Rel ms 3 D 918(a1a) a2a (Ausgabe I)
WIDEBAND AMPLIFIER 0,2 TO 1600 kHz Rel ms 3 D 918(a1a) a2a (ISSUE I)

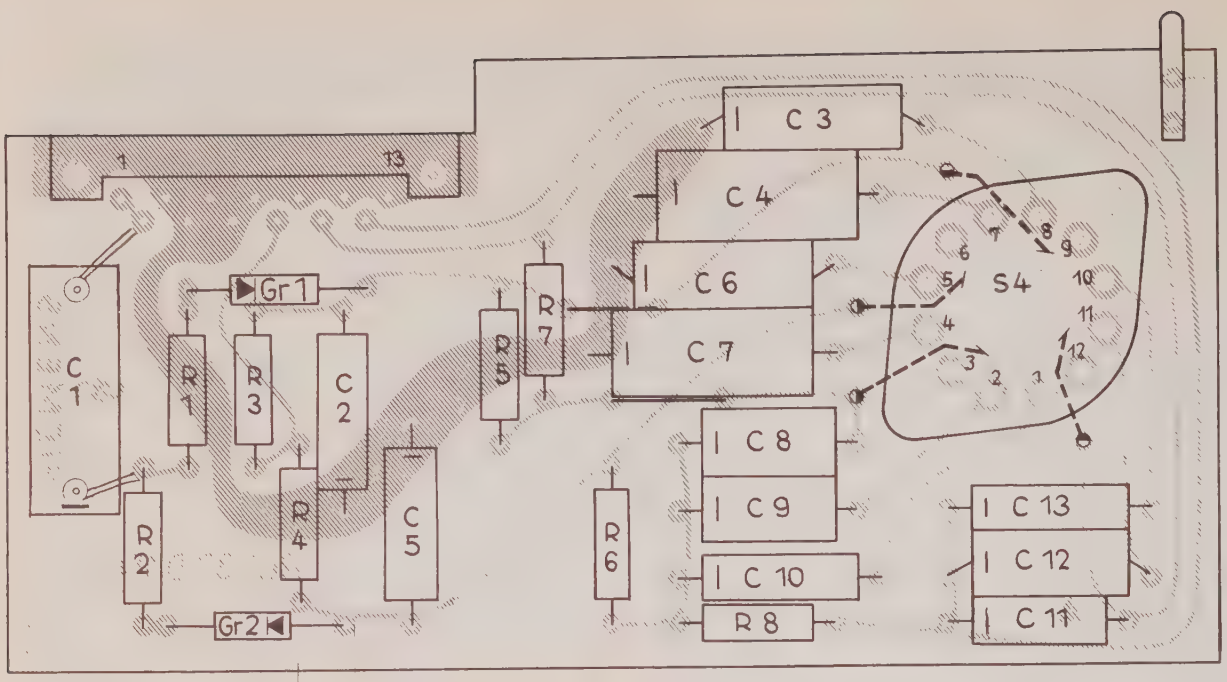
	Ausfg. MODEL 1a	2a		
			Tantal-Elektrolyt-Kondensator TANTAL ELECTROLYTIC CAPACITOR	
C 1,21	2	2	2,2µF ±20%; 20V-	B45170-A3225-M
C 2,9 22,29	4	4	6,8µF ±20%; 35V-	B45170-A4685-M
C 3,23	2	2	15µF ±20%; 20V-	B45170-A3156-M
C 5,25	2	2	150µF ±20%; 6V-	B45170-A0157-M
C 11,31	2	2	±20%; 20V- Wert wie eingebaut VALUE AS MOUNTED	B45170-
C 12	1	1	22µF ±20%; 35V-	B45170-A4226-M
C 4,10 24,30	4	4	MKL-Kondensator MKL-CAPACITOR 0,22µF ±20%; 63V-	B32110-A9224-M
C 6,26	2	2	Lufttrimmer AIR-DIELECTRIC TRIMMER 1,9-11,0pF 250V-	Rel ko 131 f
C 7,27	2	2	Styroflex-Kondensator STYROFLEX CAPACITOR 5pF ±1pF; 500V-	B31141-A5050-F
			Diode DIODE	
Gr 1,2,3 4,5,6,8	7	7	J_Z = 10mA; U_{Sp} = 75V-	1 N 914
Gr 7	1	1	J_D = 50mA; U_{Sp} = 90V-	OA 85
			Schichtwiderstand LAYER-TYPE RESISTOR	
R 1,21	2	2	15kΩ ±1%; 0,1W	B51263-A9153-F
R 2,5 22,25	4	4	270Ω ±5%; 0,25W	B51263-A2271-J
R 3,23	2	2	2,2kΩ ±5%; 0,25W	B51263-A2222-J
R 4,24	2	2	3,9kΩ ±5%; 0,25W	B51263-A2392-J
R 6,26	2	2	9,1Ω ±1%; 0,15W	B 51264 A 9,1 Ω 1/0,5
R 7,27	2	2	82Ω ±5%; 0,15W	B51263-A2820-J
R 10,30	2	2	600Ω ±5%; 0,25W	B51263-A2601-J
R 11,31	2	2	7,5Ω ±5%; 0,33W	B 51264 A 7,5Ω 5/2
R 13	1	1	655Ω ±1%; 0,1W	B51263-A9651-F500
R 17,37	2	2	10kΩ ±5%; 0,25W	B51263-A2103-J
R 33	1	-	820Ω ±1%; 0,1W	B51263-A9821-F
	-	1	750Ω ±1%; 0,1W	B51263-A9751-F

	1a	2a		
			Schichtwiderstand LAYER-TYPE RESISTOR	
R 41	1	1	13kΩ ±5%; 0,25W	B51263-A2133-J
R 43	1	1	3,6kΩ ±5%; 0,25W	B51263-A2362-J
R 44	1	1	2kΩ ±5%; 0,25W	B51263-A2202-J
R 45	1	1	2,85kΩ ±1%; 0,25W	B51263-A9282-F500
			Schichtdrehwiderstand LAYER-TYPE VAR RESISTOR	
R 8,28 46	3	3	1kΩ lin 0,1W	1 kΩ lin Rel wd 146d
R 42	1	1	10kΩ lin 0,1W	10 kΩ lin Rel wd 146d
			Metallschichtwiderstand METALLIZED LAYER-TYPE RESISTOR	
R 9,15 29,35,36	5	5	10Ω ±5%; 0,33W	B54413-A2100-J
R 39	1	1	1Ω ±5%; 0,5W	B54401-A2010-J
			Transistor TRANSISTOR	
Ts 1,6	2	2		BFY 34
Ts 2,3,4 7,8,9	6	6		2 N 2218
Ts 5	1	1		BCY 58/VIII
Ts 10	1	1		ASY 25



Verstärkerstufe 1 und 2 Rel ms 35 D 717a1a (Ausgabe II)
AMPLIFIER STAGES 1 AND 2 Rel ms 35 D 717a1a (ISSUE II)

C 1	1	MKM-Kondensator MKM-CAPACITOR 1µF ±5%; 160V-	B32435-A2105-J
		MKH-Kondensator MKH-CAPACITOR	
C 2,5	2	0,022µF ±20%; 250V-	B32220-J3223-M
C 10	1	0,033µF ±20%; 250V-	B32220-J3333-M
C 13	1	0,01µF ±20%; 250V-	B32220-J3103-M
		MKL-Kondensator MKL CAPACITOR	
C 3,6	2	0,1µF ±20%; 250V-	B32110-C2104-M
C 4,7	2	0,47µF ±20%; 250V-	B32110-C2474-M
		Styroflex-Kondensator STYROFLEX CAPACITOR	
C 8	1	1000pF ±10%; 500V-	B31141-A5102-K
C 9	1	3300pF ±10%; 125V-	B31141-A1332-K
C 11	1	330pF ±10%; 500V-	B31141-A5331-M
C 12	1	680pF ±10%; 500V-	B31141-A5681-M
Gr 1,2	2	Richtleiter RECTIFIER	Rel Bv 672 R 119
		Schichtwiderstand LAYER-TYPE RESISTOR	
R 1,2	2	2kΩ ±1%; 0,1W	B51263-A9202-F
R 3,4	2	10kΩ ±1%; 0,1W	B51263-S9103-F
R 5,6	2	33kΩ ±5%; 0,25W	B51263-A2333-J
R 7,8	2	100kΩ ±5%;0,25W	B51263-A2104-J
S 4	1	Kleinstufenschalter MIDGET ROTARY SWITCH	162 4 E- 7 A

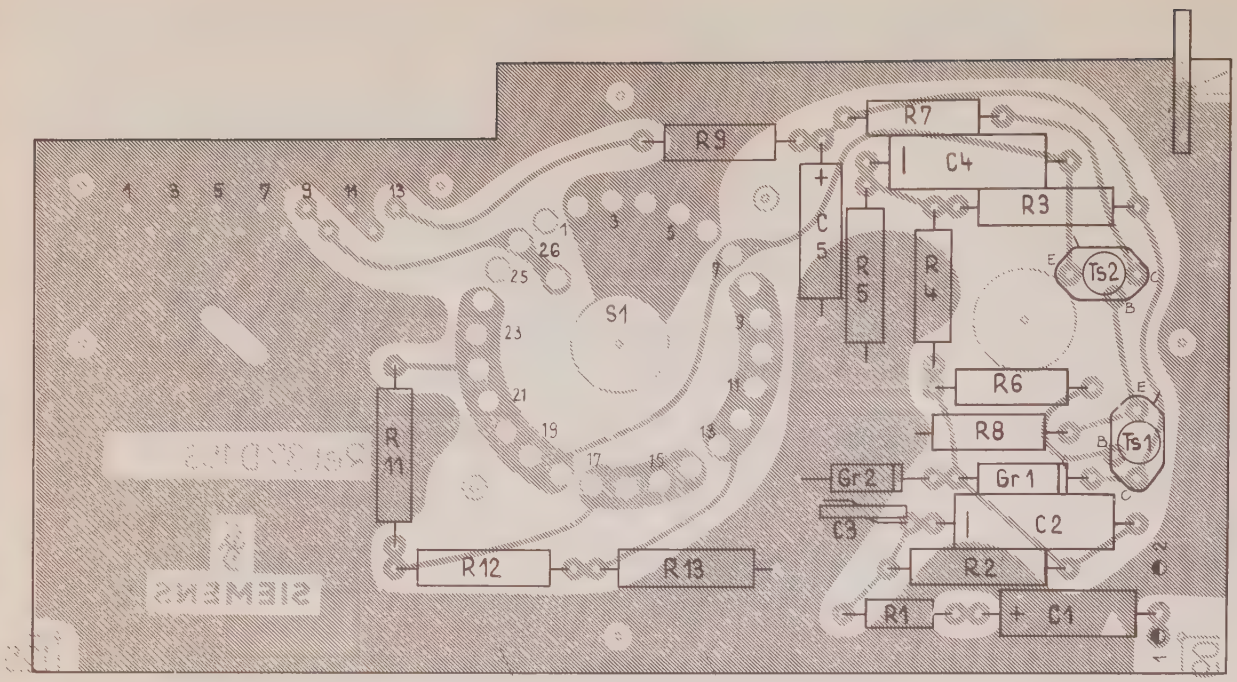


Messgleichrichter Rel ms 35 D 719a1a (Ausgabe II)
MEASURING DEMODULATOR Rel ms 35 D 719a1a (ISSUE II)

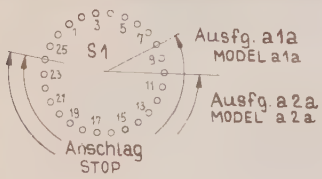
Schalterbaugruppe Rel 35 D 720a 1a,2a (Ausgabe I)
SWITCH SUBASSEMBLY (ISSUE I)

Ausfg. MODEL 1a	2a			
1	1	Eingangsstufe und Teiler 1 INPUT STAGE AND DIVIDER 1	Rel Sk 35 D 716a 1a,2a	5-45
1	1	Teiler 2 DIVIDER 2	Rel Sk 35 D 718a 1a,2a	5-47

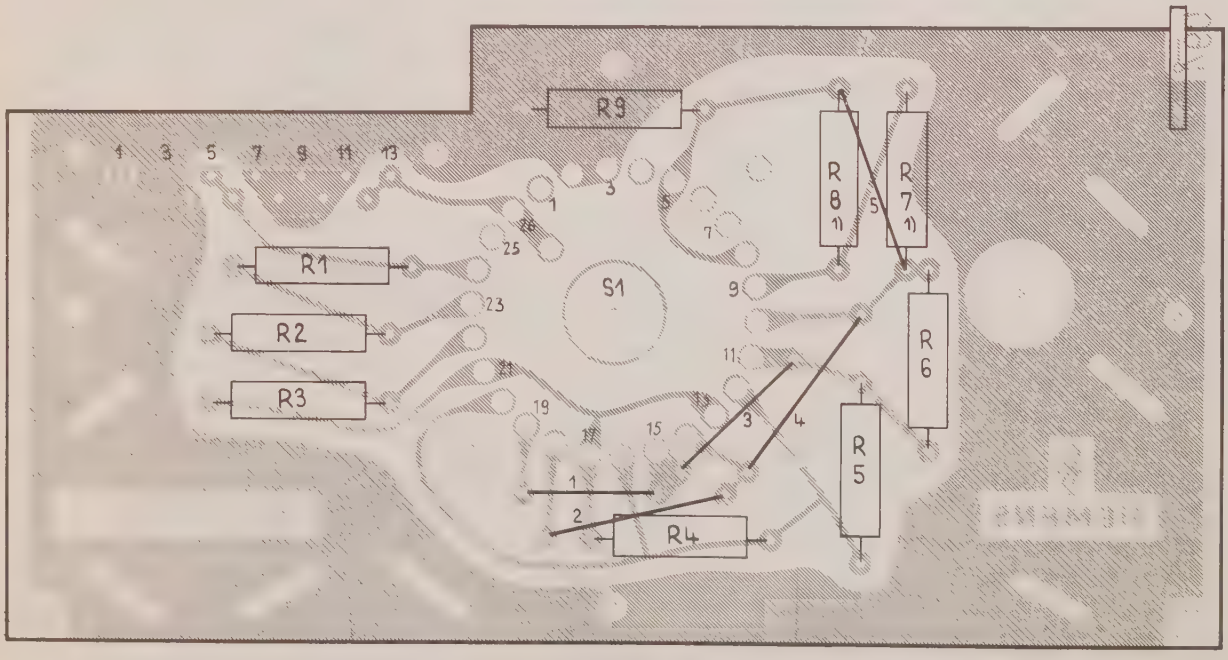
	Ausfg. MODEL 1a	2a		
			Tantal-Elektrolyt-Kondensator TANTAL ELECTROLYTIC CAPACITOR	
C 1	1	1	10µF ±20%; 6V-	B45170-A0106-M
C 5	1	1	6,8µF ±20%; 35V-	B45170-A4685-M
C 2	1	1	MKH-Kondensator MKH-CAPACITOR 0,01µF ±20%; 400V-	B32220-J6103-M
C 3	1	1	Keramik-Kondensator CERAMIC CAPACITOR 47pF ±5%; 500V-	B38217-J5470-J
C 4	1	1	MKL-Kondensator MKL-CAPACITOR 0,33µF ±20%; 63V-	B32110-D9334-M
Gr 1,2	2	2	Diode DIODE J_D = 10mA; U_{Sp} = 75V-	1 N 914
			Schichtwiderstand LAYER-TYPE RESISTOR	
R 1	1	1	10Ω ±20%; 0,1W	B51261 A 10 Ω 20/5
R 2	1	1	10kΩ ±5%; 0,33W	B 51264 A 10 K 5/2
R 3	1	1	470kΩ ±5%; 0,33W	B 51264 A 470 K 5/2
R 4	1	1	100kΩ ±5%; 0,25W	B51263-A2104-J
R 5	1	1	390kΩ ±5%; 0,33W	B 51264 A 390 K 5/2
R 6	1	1	100Ω ±5%; 0,25W	B51263-A2101-J
R 7	1	1	47Ω ±5%; 0,25W	B51263-A2470-J
R 8	1	1	27kΩ ±5%; 0,25W	B51263-A2273-J
			Metallschichtwiderstand METALLIZED LAYER-TYPE RESISTOR	
R 9	1	1	10Ω ±5%; 0,33W	B54413-A2100-J
R 11	1	-	863,6Ω ±0,2%; 0,15W	B54992-A9861-C362
	-	1	899,4Ω ±0,2%; 0,15W	B54992-A9891-C942
R 12	1	-	118,0Ω ±0,2%; 0,15W	B54992-A9111-C802
	-	1	90,6Ω ±0,2%; 0,15W	B54992-A9900-C602
R 13	1	-	18,34Ω ±0,2%; 0,15W	B54992-A9180-C342
	-	1	10Ω ±0,2%; 0,15W	B54992-A9100-C002
Ts 1,2	1	1	Transistor TRANSISTOR	BCY 58/VII[1]



Rel 37 D 153 Leiterbahnen auf der Rückseite
CURRENT PATHS ON THE REAR



Eingangsstufe und Teiler 1 Rel ms 35 D 716a1a, 2a (Ausgabe II)
INPUT STAGE AND DIVIDER 1 Rel ms 35 D 716a1a, 2a (ISSUE II)

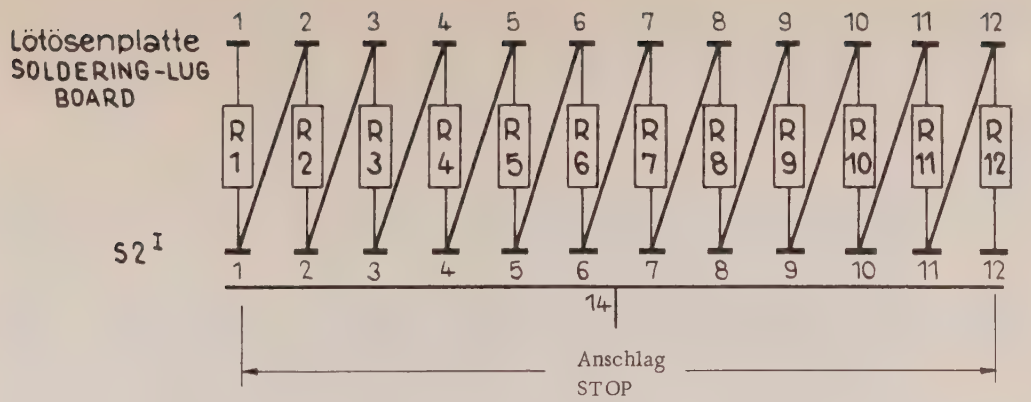


Rel 37 D 155 Leiterbahnen auf der Rückseite
CURRENT PATHS ON THE REAR

Teiler 2 Rel ms 35 D 718a1a, 2a (Ausgabe II)
DIVIDER 2 Rel ms 35 D 718a1a, 2a (ISSUE II)

	Ausfg. MODEL 1a	2a		
			Metallschichtwiderstand METALLIZED LAYER-TYPE RESISTOR	
R 1	1	-	383,9Ω ±0,2%; 0,15W	B54992-A9381-C392
	-	1	428,5Ω ±0,2%; 0,15W	B54992-A9421-C852
R 2	1	-	242,5Ω ±0,2%; 0,15W	B54992-A9241-C252
	-	1	250,7Ω ±0,1%; 0,15W	B54992-A9241-C072
R 3	1	-	147,9Ω ±0,2%; 0,15W	B54992-A9141-C792
	-	1	141,3Ω ±0,2%; 0,15W	B54992-A9141-C132
R 4	1	-	89,34Ω ±0,2%; 0,15W	B54992-A9890-C342
	-	1	78,93Ω ±0,2%; 0,15W	B54992-A9780-C932
R 5	1	-	53,9Ω ±0,2%; 0,15W	B54992-A9530-C902
	-	1	44,17Ω ±0,2%; 0,15W	B54992-A9440-C172
R 6	1	-	32,54Ω ±0,2%; 0,15W	B54992-A9320-C542
	-	1	24,75Ω ±0,2%; 0,15W	B54992-A9240-C752
C 7	1	-	19,67Ω ±0,2%; 0,15W	B54992-A9190-C672
R 8	1	-	11,94Ω ±0,2%; 0,15W	B54992-A9110-C942
R 9	1	-	18,34Ω ±0,2%; 0,15W	B54992-A9180-C342
	-	1	31,68Ω ±0,2%; 0,15W	B54992-A9310-C682

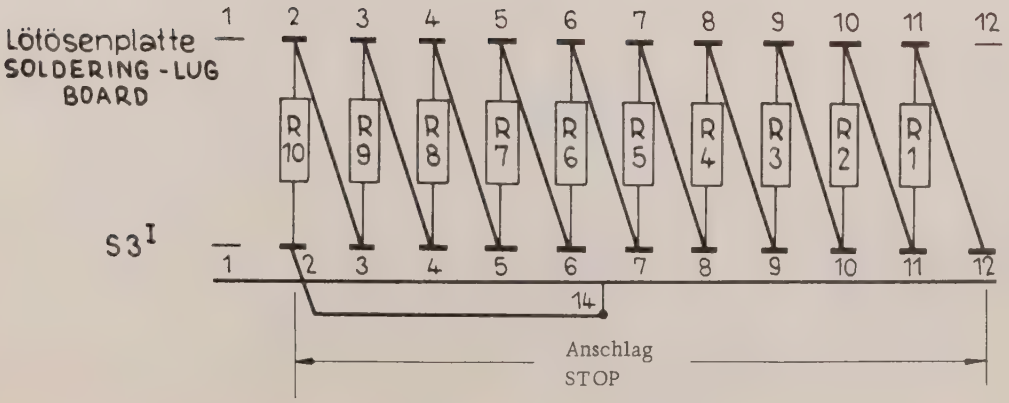
	Ausfg. MODEL 1a (0,1 Np)	2a (1 dB)		
			Metallschichtwiderstand METALLIZED LAYER-TYPE RESISTOR	
R 1	1	-	3,329kΩ ±0,2%; 0,15W	B54992-A9332-C292
	-	1	2,818kΩ ±0,2%; 0,15W	B54992-A9282-C182
R 2	1	-	350,1Ω ±0,2%; 0,15W	B54992-A9351-C012
	-	1	343,9Ω ±0,2%; 0,15W	B54992-A9341-C392
R 3	1	-	386,9Ω ±0,2%; 0,15W	B54992-A9381-C692
	-	1	385,9Ω ±0,2%; 0,15W	B54992-A9381-C592
R 4	1	-	427,6Ω ±0,2%; 0,15W	B54992-A9421-C762
	-	1	432,9Ω ±0,2%; 0,15W	B54992-A9431-C292
R 5	1	-	472,6Ω ±0,2%; 0,15W	B54992-A9471-C262
	-	1	485,8Ω ±0,2%; 0,15W	B54992-A9481-C582
R 6	1	-	522,3Ω ±0,2%; 0,15W	B54992-A9521-C232
	-	1	545,0Ω ±0,2%; 0,15W	B54992-A9541-C502
R 7	1	-	577,2Ω ±0,2%; 0,15W	B54992-A9571-C722
	-	1	611,6Ω ±0,2%; 0,15W	B54992-A9611-C162
R 8	1	-	637,9Ω ±0,2%; 0,15W	B54992-A9631-C792
	-	1	686,2Ω ±0,2%; 0,15W	B54992-A9681-C622
R 9	1	-	705,0Ω ±0,2%; 0,15W	B54992-A9701-C502
	-	1	769,9Ω ±0,2%; 0,15W	B54992-A9761-C992
R 10	1	-	779,2Ω ±0,2%; 0,15W	B54992-A9771-C922
	-	1	863,8Ω ±0,2%; 0,15W	B54992-A9861-C382
R 11	1	-	861,0Ω ±0,2%; 0,15W	B54992-A9861-C102
	-	1	969,2Ω ±0,2%; 0,15W	B54992-A9961-C922
R 12	1	-	951,6Ω ±0,2%; 0,15W	B54992-A9951-C162
	-	1	1,087kΩ ±0,2%; 0,15W	B54992-A9102-C872
R 13	1	1	Schichtwiderstand LAYER-TYPE RESISTOR 90kΩ ±1%; 0,1W	B51263-A9903-F
S 2	1	1	Drehschalter ROTARY SWITCH 1polig; 1 Ebene; 12stufig 1-POLE; 1-DECK; 12-STEP	Rel sch 175 F,Form


Lötösenplatte
SOLDERING-LUG BOARD
1 2 3 4 5 6 7 8 9 10 11 12
R 1 R 2 R 3 R 4 R 5 R 6 R 7 R 8 R 9 R 10 R 11 R 12
S2 I
1 2 3 4 5 6 7 8 9 10 11 12
14
Anschlag
STOP

Messlinienteiler 0,1 Np/1 dB Rel ms 35 D 728a1a, 2a (Ausgabe I)
MEASURING-LINE DIVIDER 0,1 Np/1 dB Rel ms 35 D 728a1a, 2a (ISSUE I)

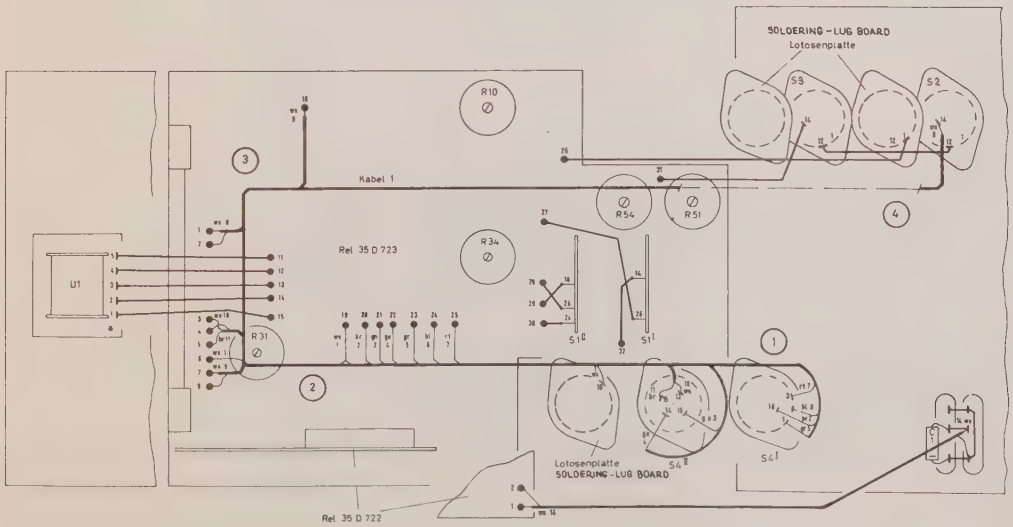
Meßlinienteiler 0,01 Np/0,1 dB Rel 35 D 729a 1a,2a (Ausg.III)
MEASURING LINE DIVIDER 0,01 Np/0,1 dB (ISSUE III)

	Ausfg. MODEL 1a (0,01 Np)	2a (0,1 dB)		
			Schichtwiderstand LAYER-TYPE RESISTOR	
R 1-10	10	-	130Ω ±1%; 0,1W	B51263-A9131-F
	-	10	150Ω ±1%; 0,1W	B51263-A9151-F
S 3	1	1	Drehschalter ROTARY SWITCH 1polig; 1 Ebene;12stufig 1-POLE; 1-DECK; 12-STEP	Rel sch 175 F,Form B



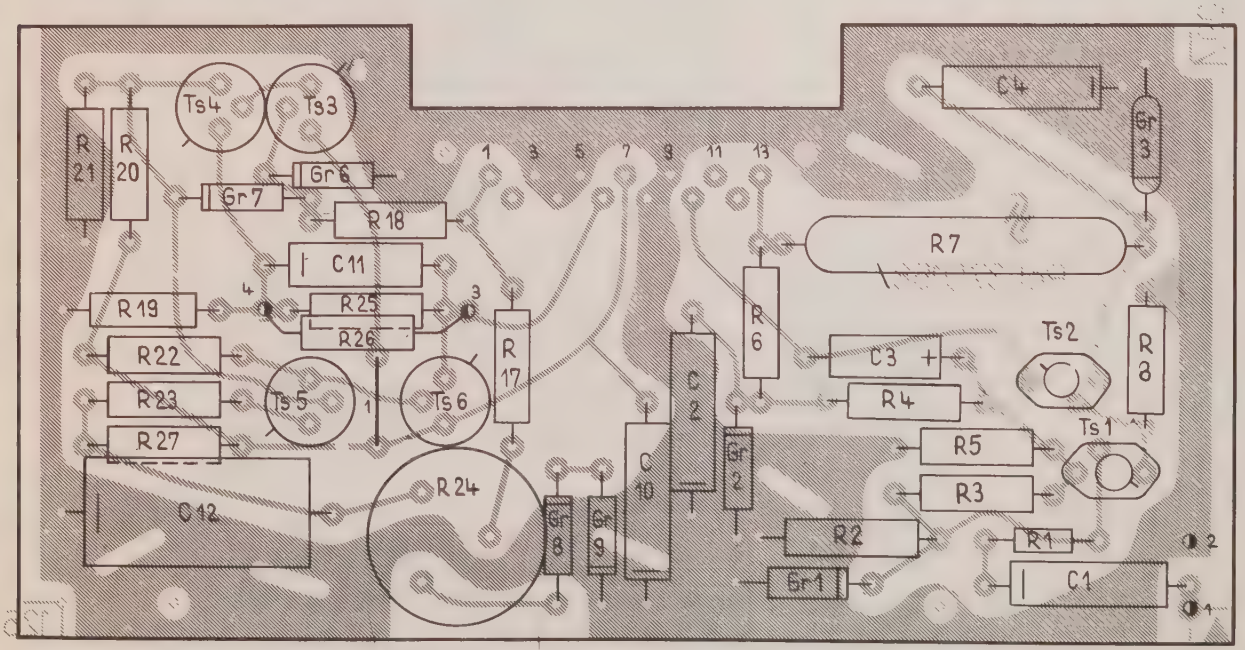
Messlinienteiler 0,01 Np/0,1 dB Rel ms 35 D 729a1a, 2a (Ausgabe I)
MEASURING-LINE DIVIDER 0,01 Np/0,1 dB Rel ms 35 D 729a1a, 2a (ISSUE I)

	Ausfg. MODEL 1a	2a			
	1	1	Eingangsstufe und Verstärker 1 INPUT STAGE AND AMPLIFIER 1	Rel Sk 35 D 722a2a	5-50
	1	1	Verstärker 2 und Gleichrichter AMPLIFIER 2 AND RECTIFIER	Rel Sk 35 D 723a2a	5-53
	1	1	Pegelschalter (Np/dB) LEVEL SWITCH	Rel Sk 35 D 724a 1a,2a	5-56
	1	1	Zeitkonstantenschalter TIME CONSTANT SWITCH	Rel Sk 35 D 725a1a	5-57
			Meßlinienteiler MEASURING LINE DIVIDER		
	1	1	0,1 Np / 1 dB	Rel 35 D 726a 1a,2a	5-58
	1	1	0,01 Np / 0,1 dB	Rel Sk 35 D 727a 1a,2a	5-59
C	1	1	Styroflex-Kondensator STYROFLEX CAPACITOR 30pF ±20%; 500V-	B31141-A5300-M	
Ü 1	1	1	Übertrager (Rel tr 63g) TRANSFORMER Wicklg. Ia (2a/5a) 4500 Wdg 2x0,05 Cu2L paral. 1. Abgriff (3a): 2250 Wdg Wicklg. Ib (1a/4a) 4500 Wdg 2x0,05 Cu2L paral.	Rel 621 D 3206	



		MKL-Kondensator MKL-CAPACITOR	
C 1	1	0,1µF ±20%; 160V-	B32110-C1104-M
C 2,4,10	3	0,1µF ±20%; 100V-	B32110-C0104-M
		Tantal-Elektrolyt-Kondensator TANTAL ELECTROLYTIC CAPACITOR 33µF ±20%; 10V-	B45170-J1336-M
C 11	1	Styroflex-Kondensator STYROFLEX CAPACITOR 5pF ±20%; 500V-	B31141-A5050-M
C 12	1	Elektrolyt-Kondensator ELECTROLYTIC CAPACITOR 100µF +50/-20%; 15V-	B41931-A4107-S
Gr 1,6,7 8,9	5	Diode DIODE J_D = 10mA; U_{Sp} = 75V-	1 N 914
		Zenerdiode ZENER DIODE	
Gr 2	1		Typ 5133c (Fa. Eberle)
Gr 3	1		Typ 5333c (Fa. Eberle)
		Schichtwiderstand LAYER-TYPE RESISTOR	
R 1	1	56kΩ ±20%; 0,075W	B51260 A 60 K 20/5
R 2	1	2MΩ ±5%; 0,33W	B51264 A 2 M 5/2
R 3	1	150kΩ ±5%; 0,25W	B51263-A2154-J
R 4	1	51kΩ ±2%; 0,25W	B51263-A2513-G
R 5	1	56kΩ ±2%; 0,25W	B51263-A2563-G
R 6	1	130kΩ ±5%; 0,25W	B51263-A2134-J
R 8	1	270kΩ ±5%; 0,25W	B51263-A2274-J
R 17	1	15kΩ ±5%; 0,25W	B51263-A2153-J
R 18	1	270Ω ±5%; 0,25W	B51263-A2271-J
R 19	1	75Ω ±1%; 0,1W	B51263-A9750-F
R 20	1	8,2kΩ ±5%; 0,25W	B51263-A2822-J
R 21	1	1,8kΩ ±5%; 0,25W	B51263-A2182-J

		Schichtwiderstand LAYER-TYPE RESISTOR	
R 22	1	10kΩ ±5%; 0,25W	B51263-A2103-J
R 23	1	220kΩ ±5%; 0,25W	B51263-A2221-J
R 25	1	1,3kΩ ±1%; 0,1W	B51263-A9132-F
R 26	1	±5%; 0,25W **Wert wie eingebaut** VALUE AS MOUNTED	B51263-
R 27	1	3,9kΩ ±5%; 0,25W	B51263-A2392-J
R 7	1	Drahtwiderstand WIRE-WOUND RESISTOR 16kΩ ±5%; 4W	GWD 4 16 kΩ 5% (Fa. Rosenthal)
R 24	1	Schichtdrehwiderstand LAYER-TYPE VAR RESISTOR 100Ω lin 0,1W	100 Ω lin Rel wd 146d
		Transistor TRANSISTOR	
Ts 1,2	2		BCY 59/Gruppe VIII
Ts 3,4 5,6	4		BFY 34



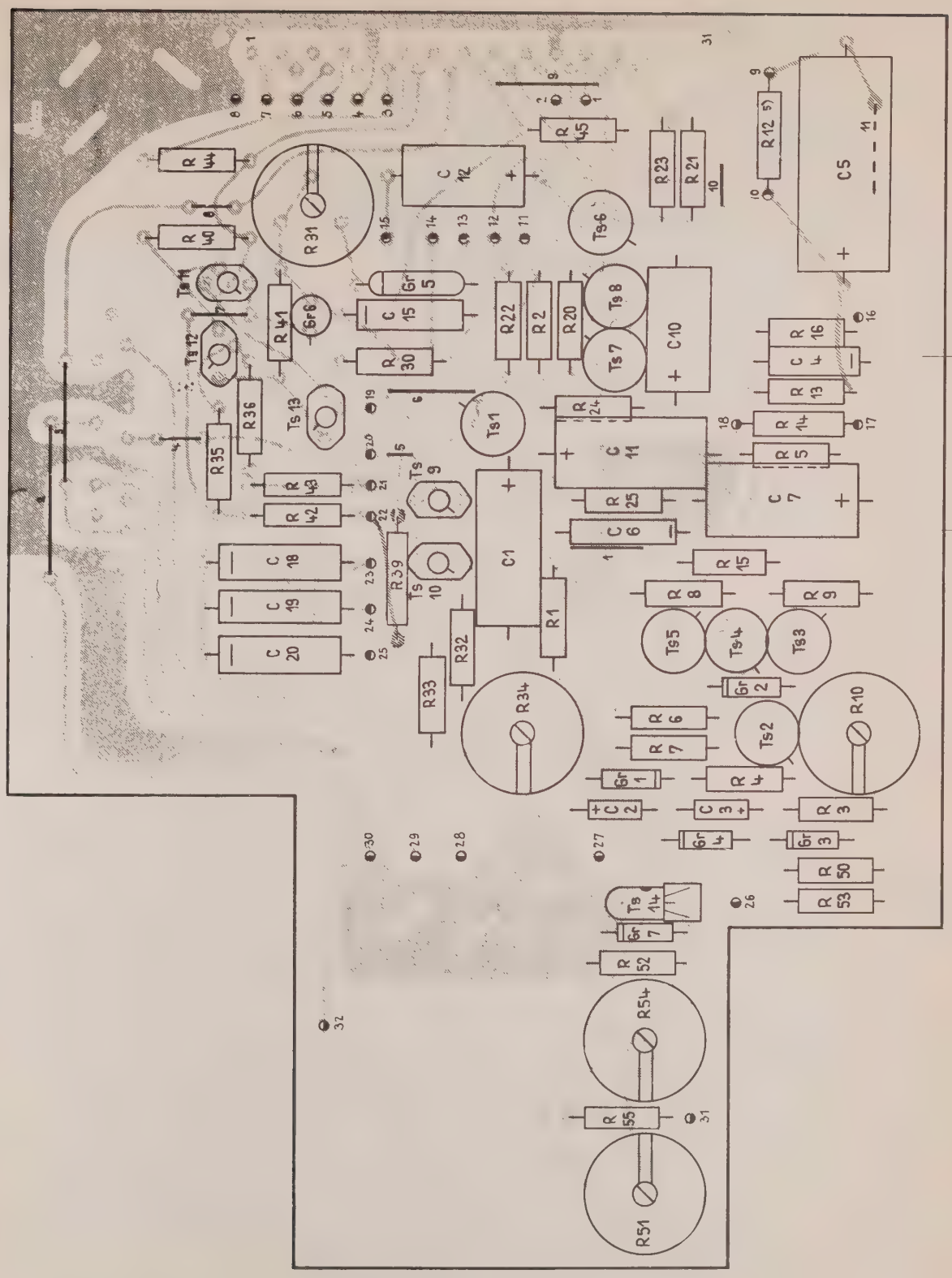
Rel 37 D 158

Strombahnen auf der Rückseite
CURRENT PATHS ON THE REAR

Eingangsstufe und Verstärker 1 — Rel ms 35 D 722a2a (Ausgabe II)
INPUT STAGE AND AMPLIFIER 1 — Rel ms 35 D 722a2a (ISSUE II)

		Elektrolyt-Kondensator ELECTROLYTIC CAPACITOR	
C 1	1	50µF +50/-20%; 35V-	B41931-A7506-S
C 5	1	50µF +30/-20%; 15V-	B41911-A4506-R
C 7	1	100µF +50/-20%; 15V-	B41931-A4107-S
C 10	1	50µF +50/-20%; 15V-	B41931-A4506-S
C 11	1	50µF +50/-20%; 35V-	B41931-S7506-S
C 12	1	25µF +50/-20%; 15V-	B41951-A4256-S
C 2,3	2	Tantal-Elektrolyt-Kondensator TANTAL ELECTROLYTIC CAPACITOR 3,3µF ±20%; 15V-	B45170-J2335-M
C 4	1	Styroflex-Kondensator STYROFLEX CAPACITOR 5pF ±20%; 500V-	B31141-A5050-M
		MKL-Kondensator MKL-CAPACITOR	
C 6,15	2	0,1µF ±20%; 100V-	B32110-C0104-M
C 18	1	0,47µF ±20%; 63V-	B32110-D9474-M
C 19	1	0,15µF ±20%; 63V-	B32110-D9154-M
C 20	1	MKH-Kondensator MKH-CAPACITOR 0,047µF ±20%; 250V-	B32220-J3473-M
		Diode DIODE	
Gr 1,2,3 4,7	5	J_D = 10mA; U_{Sp} = 75V-	1 N 914
Gr 5	1	J_D = 50mA; U_{Sp} = 90 V-	OA 85
Gr 6	1	Zenerdiode ZENER DIODE	Typ 1113c (Fa. Eeberle)
		Schichtwiderstand LAYER-TYPE RESISTOR	
R 1,20	2	4,7kΩ ±5%; 0,25W	B51263-A2472-J
R 2	1	680Ω ±5%; 0,25W	B51263-A2681-J
R 3	1	15kΩ ±5%; 0,25W	B51263-A2153-J
R 4	1	270Ω ±5%; 0,25W	B51263-A2271-J
R 5	1	75Ω ±1%; 1W	B51263-A9750-F
R 6	1	8,2kΩ ±5%; 0,25W	B51263-A2822-J

		Schichtwiderstand LAYER-TYPE RESISTOR	
R 7,21	2	1,8kΩ ±5%; 0,25W	B51263-A2182-J
R 8,16	2	10kΩ ±5%; 0,25W	B51263-A2103-J
R 9	1	220Ω ±5%; 0,25W	B51263-A2221-J
R 12	1	68Ω ±5%; 0,25W	B51263-A2680-J
R 13	1	1,3kΩ ±1%; 0,1W	B51263-A9132-F
R 14	1	±5%; 0,25W	B51263-
		Wert wie eingebaut VALUE AS MOUNTED	
R 15,24	2	3,9kΩ ±5%; 0,25W	B51263-A2392-J
R 22,23	2	1kΩ ±5%; 0,25W	B51263-A2102-J
R 25	1	180kΩ ±5%; 0,25W	B51263-A2184-J
R 30	1	100kΩ ±5%; 0,25W	B51263-A2104-J
R 32	1	7,5kΩ ±1%; 0,1W	B51263-A9752-F
R 33	1	6,8kΩ ±1%; 0,1W	B51263-A9682-F
R 35,36	2	12kΩ ±1%; 0,1W	B51263-A9123-F
R 39	1	4,7MΩ ±5%; 0,39W	B51264 A 4,7 M 5/2
R 40	1	68kΩ ±5%; 0,25W	B51263-A2683-J
R 41	1	22kΩ ±5%; 0,25W	B51263-A2223-J
R 42,43	2	39kΩ ±5%; 0,25W	B51263-A2393-J
R 44	1	82kΩ ±1%; 0,1W	B51263-A9823-F
R 45	1	47kΩ ±1%; 0,1W	B51263-A9473-F
R 50	1	13kΩ ±5%; 0,25W	B51263-A2133-J
R 51	1	10kΩ lin 0,1W	10 kΩ lin Rel wd 146d
R 52	1	2kΩ ±5%; 0,25W	B51263-A2202-J
R 53	1	3,6kΩ ±5%; 0,25W	B51263-A2362-J
R 55	1	2,85kΩ ±1%; 0,25W	B51263-A9282-F500
		Schichtdrehwiderstand LAYER-TYPE VAR RESISTOR	
R 10	1	100Ω lin 0,1W	100 Ω lin Rel wd 146d
R 31	1	5kΩ lin 0,1W	5 kΩ lin Rel wd 146d
R 34,54	2	1kΩ lin 0,1W	1 kΩ lin Rel wd 146d
		Transistor TRANSISTOR	
Ts 1-8	8		BFY 34
Ts 9,10	2		2 N 708
Ts 11,12,13	3		BCY 59/Gruppe VIII
Ts 14	1		ASY 11

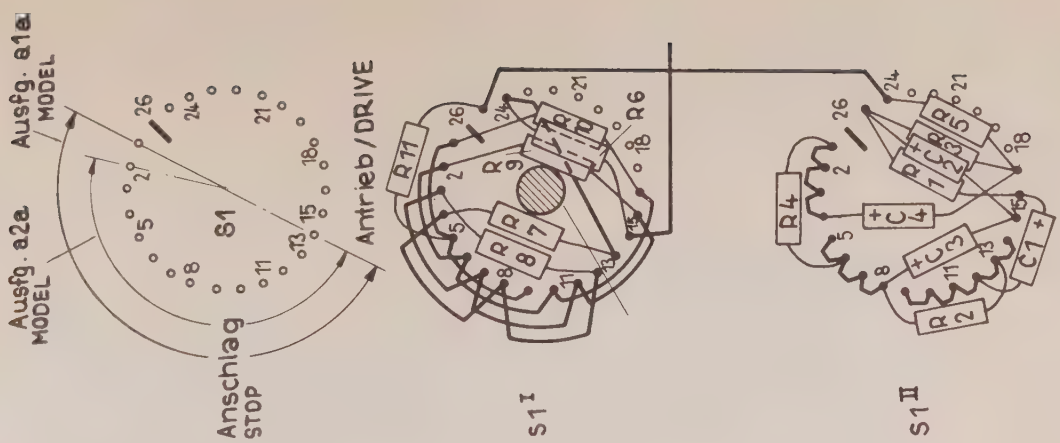


Verstärker 2 und Gleichrichter
AMPLIFIER 2 AND RECTIFIER

Rel ms 35 D 723a2a (Ausgabe II)
Rel ms 35 D 723a2a (ISSUE II)

Pegelschalter Rel 35 D 724a 1a,2a (Ausgabe I)
LEVEL SWITCH (ISSUE I)

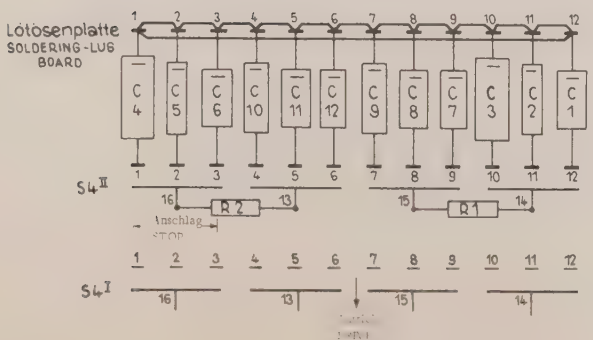
	Ausfg. MODEL 1a	2a		
			Tantal-Elektrolyt-Kondensator TANTAL ELECTROLYTIC CAPACITOR	
C 1	1	1	3,3µF ±20%; 20V-	B45170-J3335-M
C 2,3	2	2	6,8µF ±20%; 6V-	B45170-J0685-M
C 4	1	1	3,3µF ±20%; 6V-	B45170-J0335-M
			Schichtwiderstand LAYER-TYPE RESISTOR	
R 1	1	-	2,594kΩ ±0,2%; 0,15W	B54992-A9252-C942
	-	1	2,697kΩ ±0,2%; 0,15W	B54992-A9262-C972
R 2	1	1	2,7MΩ ±5%; 0,33W	B51264 A 2,7 M 5/2
R 3	1	-	360,7Ω ±0,2%; 0,15W	B54992-A9361-C072
	-	1	273,7Ω ±0,2%; 0,15W	B54992-A9271-C372
R 4	1	-	390kΩ ±5%; 0,25W	B51263-A2394-J
	-	1	270kΩ ±5%; 0,25W	B51263-A2274-J
R 5	1	-	55,0Ω ±0,2%; 0,15W	B54992-A9550-C002
	-	1	29,86Ω ±0,2%; 0,15W	B54992-A9290-C862
R 6	1	-	383,9Ω ±0,2%; 0,15W	B54992-A9381-C392
	-	1	428,5Ω ±0,2%; 0,15W	B54992-A9421-C852
R 7	1	-	242,5Ω ±0,2%; 0,15W	B54992-A9241-C252
	-	1	250,7Ω ±0,2%; 0,15W	B54992-A9251-C072
R 8	1	-	147,9Ω ±0,2%; 0,15W	B4992-A9141-C792
	-	1	141,3Ω ±0,2%; 0,15W	B54992-A9141-C132
R 9	1	-	89,34Ω ±0,2%; 0,15W	B54992-A9890-C342
	-	1	78,93Ω ±0,2%; 0,15W	B54992-A9780-C932
R 10	1	-	53,90Ω ±0,2%; 0,15W	B54992-A9530-C902
	-	1	44,17Ω ±0,2%; 0,15W	B54992-A9440-C172
R 11	1	-	82,49Ω ±0,2%; 0,15W	B54992-A9820-C492
	-	1	56,43Ω ±0,2%; 0,15W	B54992-A9560-C432
S 1	1	1	Drehschalter ROTARY SWITCH 1polig; 2 Ebenen; 25 Stellungen 1-POLE; 2-DECK; 25-POSITIONS	Rel sch 161 if Form A



Pegelschalter — Rel ms 35 D 724a1a, 2a (Ausgabe I)
LEVEL SWITCH — Rel ms 35 D 724a1a, 2a (ISSUE I)

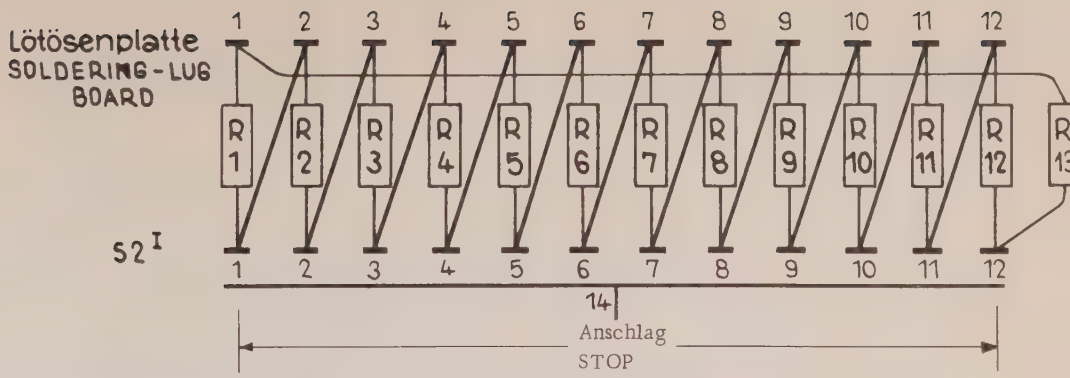
Zeitkonstantenschalter Rel 35 D 725a1a (Ausgabe I)
TIME CONSTANT SWITCH (ISSUE I)

		MKH-Kondensator MKH-CAPACITOR	
C 1,6 8,11	4	0,022µF ±20%; 250V-	B32220-J3223-M
C 2,5	2	0,068µF ±20%; 250V-	B32220-J3683-M
C 7,12	2	0,01µF ±20%; 250V-	B32220-J3103-M
		MKL-Kondensator MKL-CAPACITOR	
C 3,4	2	0,22µF ±20%; 63V-	B32110-D9224-M
C 9,10	2	0,1µF ±20%; 100V-	B32110-C0104-M
R 1,2	2	Schichtwiderstand LAYER-TYPE RESISTOR 120kΩ ±5%; 0,25W	B51263-A2124-J
S 4	1	Drehschalter ROTARY SWITCH 4polig; 2 Ebenen; 12 Stellungen 4-POLE; 2-DECK; 12-POSITIONS	C42315-A48-A3



Zeitkonstantenschalter — Rel ms 35 D 725a1a (Ausgabe I)
TIME CONSTANT SWITCH — Rel ms 35 D 725a1a (ISSUE I)

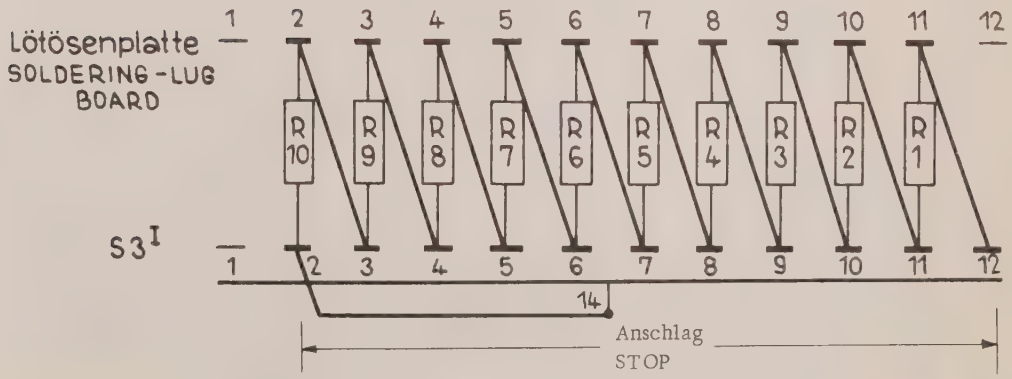
	Ausfg. MODEL 1a	2a		
			Schichtwiderstand LAYER-TYPE RESISTOR	
R 1	1	-	3,329kΩ ±0,2%; 0,15W	B54992-A9332-C292
	-	1	2,818kΩ ±0,2%; 0,15W	B54992-A9282-C182
R 2	1	-	350,1Ω ±0,2%; 0,15W	B54992-A9351-C012
	-	1	343,9Ω ±0,2%; 0,15W	B54992-A9341-C392
R 3	1	-	386,9Ω ±0,2%; 0,15W	B54992-A9381-C692
	-	1	385,9Ω ±0,2%; 0,15W	B54992-A9381-C592
R 4	1	-	427,6Ω ±0,2%; 0,15W	B54992-A9421-C762
	-	1	432,9Ω ±0,2%; 0,15W	B54992-A9431-C292
R 5	1	-	472,6Ω ±0,2%; 0,15W	B54992-A9471-C262
	-	1	485,8Ω ±0,2%; 0,15W	B54992-A9481-C582
R 6	1	-	522,3Ω ±0,2%; 0,15W	B54992-A9521-C232
	-	1	545,0Ω ±0,2%; 0,15W	B54992-A9541-C502
R 7	1	-	577,2Ω ±0,2%; 0,15W	B54992-A9571-C722
	-	1	611,6Ω ±0,2%; 0,15W	B54992-A9611-C162
R 8	1	-	637,9Ω ±0,2%; 0,15W	B54992-A9631-C792
	-	1	686,2Ω ±0,2%; 0,15W	B54992-A9681-C622
R 9	1	-	705,0Ω ±0,2%; 0,15W	B54992-A9701-C502
	-	1	769,9Ω ±0,2%; 0,15W	B54992-A9761-C992
R 10	1	-	779,2Ω ±0,2%; 0,15W	B54992-A9771-C922
	-	1	863,8Ω ±0,2%; 0,15W	B54992-A9861-C382
R 11	1	-	861,0Ω ±0,2%; 0,15W	B54992-A9861-C102
	-	1	969,2Ω ±0,2%; 0,15W	B54992-A9961-C922
R 12	1	-	951,6Ω ±0,2%; 0,15W	B54992-A9951-C162
	-	1	1,087kΩ ±0,2%; 0,15W	B54992-A9102-C872
R 13	1	-	270kΩ ±5%; 0,25W	B51263-A2274-J
	-	1	100kΩ ±5%; 0,25W	B51263-A2104-J
S 2	1	1	Drehschalter ROTARY SWITCH 1polig; 1 Ebene; 12 Stellungen 1-POLE; 1-DECK; 12-POSITIONS	Q42474-A3116-A3


Lötösenplatte
SOLDERING-LUG BOARD
1 2 3 4 5 6 7 8 9 10 11 12
R 1 R 2 R 3 R 4 R 5 R 6 R 7 R 8 R 9 R 10 R 11 R 12 R 13
S2I
1 2 3 4 5 6 7 8 9 10 11 12
14
Anschlag
STOP

Messlinienteiler 0,1 Np/1 dB — Rel ms 35 D 726a1a, 2a (Ausgabe I)
MEASURING-LINE DIVIDER 0,1 Np/1 dB — Rel ms 35 D 726a1a, 2a (ISSUE I)

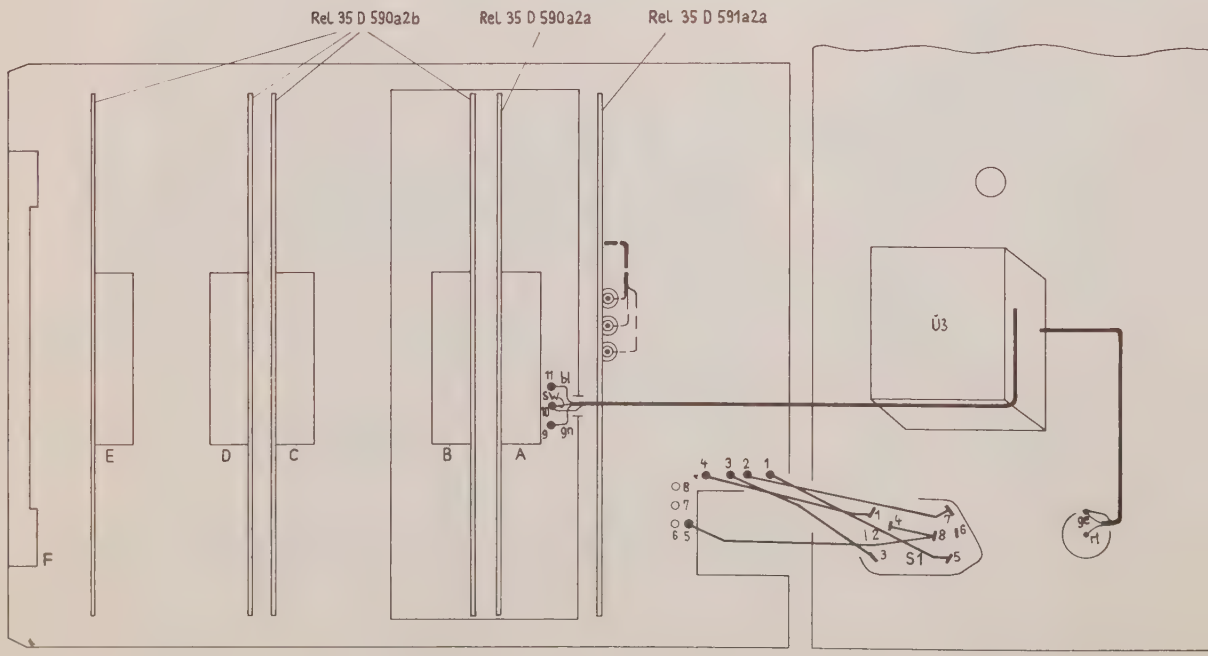
Meßlinienteiler 0,01 Np/0,1 dB Rel 35 D 727a 1a,2a (Ausgabe I)
MEASURING-LINE DIVIDER 0,01 Np/0,1 dB (ISSUE I)

	Ausfg. MODEL 1a	2a		
			Schichtwiderstand LAYER-TYPE RESISTOR	
R 1-10	10	-	130Ω ±1%; 0,1W	B51263-A9131-F
	-	10	150Ω ±1%; 0,1W	B51263-A9151-F
	1	1	Drehschalter ROTARY SWITCH 1polig; 1 Ebene; 12 Stellungen 1-POLE; 1-DECK; 12-POSITIONS	C42474-A3116-A3



Messlinienteiler 0,01 Np/0,1 dB — Rel ms 35 D 727a1a, 2a (Ausgabe I)
MEASURING-LINE DIVIDER 0,01 Np/0,1 dB — Rel ms 35 D 727a1a, 2a (ISSUE I)

	Ausfg. MODEL 1a	2a			
	5	5	Verstärkerplatte AMPLIFIER BOARD	Rel Sk 35 D 590a 2a,2b	5-61
	1	1	Meßlinienteiler MEASURING-LINE DIVIDER	Rel Sk 35 D 591a 1a,2a	5-63
	1	1	Aufnahmeplatte MOUNTING PLATE	Rel Sk 35 D 592a2a	5-64
S 1	1	1	Drehschalter ROTARY SWITCH 2polig; 1 Ebene; 3 Stellungen 2-POLE; 1-DECK; 3-POSITIONS	Rel sch 300aa, Form B	
Ü 3	1	1	Schalenkernspule SHELL-CORE COIL Wicklg. I (ge/rt) 127 Wdg 0,22 CuL; 2,6Ω Wicklg. II (sw/bl) 150 Wdg 0,22 CuL 3,2Ω 1. Abgriff (gn) 69 Wdg	Rel Bv 622 P 3439	

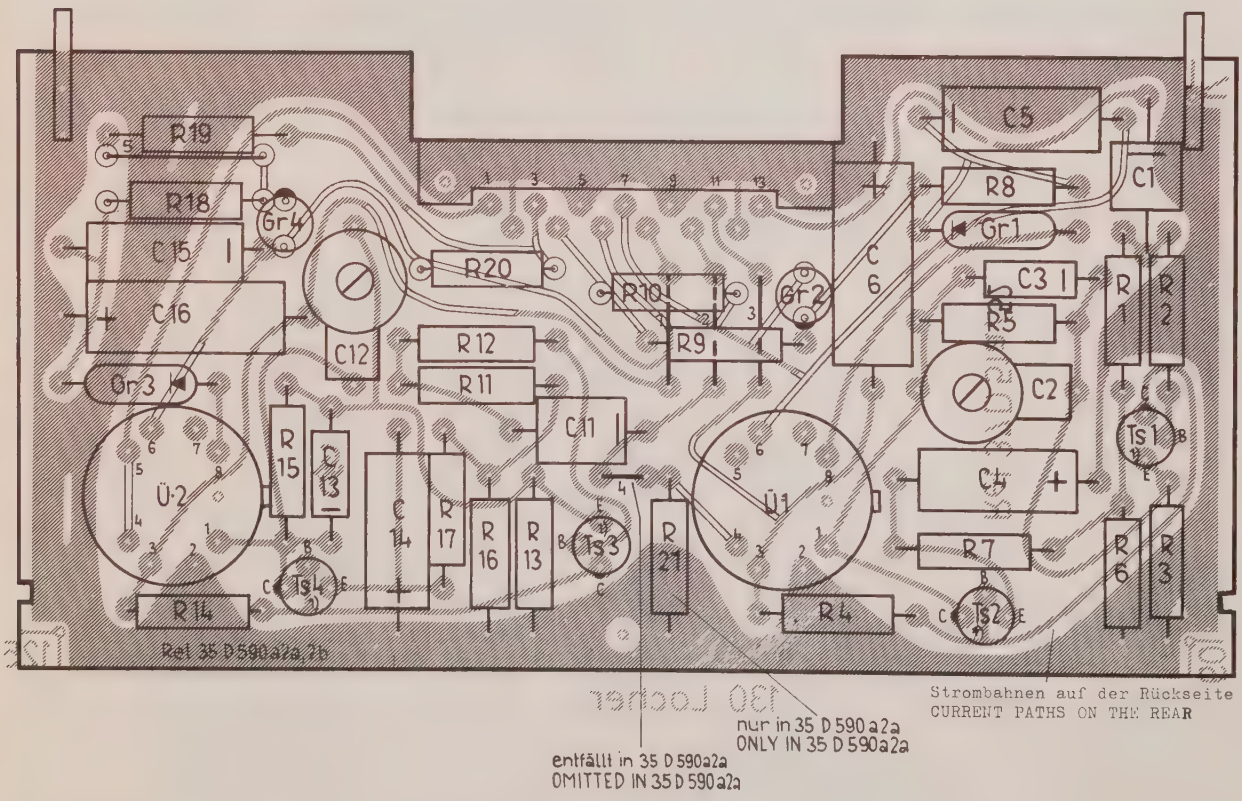


Logarithmischer ZF-Verstärker Rel ms 3 D 920a1a, 2a (Ausgabe III)
LOGARITHMIC IF AMPLIFIER Rel ms 3 D 920a1a, 2a (ISSUE III)

	Ausfg. MODEL 2a	2b		
			Styroflex-Kondensator STYROFLEX CAPACITOR	
C 1,11	2	2	4000pF ±5%; 125V-	B31140-A1402-J
C 3,13	2	2	20pF ±5%; 125V-	B31140-A1200-J
C 2,12	2	2	Keramischer Scheibentrimmer CERAMIC DISC-TYPE TRIMMER 6/30pF	Rel ko 139e
			Elektrolyt-Kondensator ELECTROLYTIC CAPACITOR	
C 4,14	2	2	10µF +50/-20%; 6V-	B41951-A2106-S
C 6,16	2	2	10µF +50/-20%; 35V-	B41951-A7106-S
C 5,15	2	2	MKL-Kondensator MKL-CAPACITOR 0,1µF ±20%; 100V-	B32110-D0104-M
Gr 1,3	2	2	Germanium-Diode GERMANIUM DIODE	OA 150 (Fa.Telefunken)
			Zenerdiode ZENER DIODE	
Gr 2	1	-	J_Z=5mA; r_Z=7Ω; U_Z=8,2V-	SZ 8 KB
Gr 4	1	-	J_Z=5mA; r_Z=40Ω; U_Z=6,2V-	SZ 6 KB
Gr 2,4	-	2	J_Z=5mA; r_Z=40Ω; U_Z=6,2V-	SZ 6 KB
			Schichtwiderstand LAYER-TYPE RESISTOR	
R 1,11	2	2	2kΩ ±1%; 0,1W	B51263-A2202-F
R 2,12	2	2	1kΩ ±5%; 0,25W	B51263-A2102-J
R 3,13	2	2	1kΩ ±1%; 0,1W	B51263-A9102-F
R 4,14	2	2	8kΩ ±5%; 0,25W	B51263-A2802-J
R 5,15	2	2	10kΩ ±1%; 0,1W	B51263-A9103-F
R 6,16	2	2	400Ω ±5%; 0,25W	B51263-A2401-J
R 7,17	2	2	300Ω ±5%; 0,25W	B51263-A2301-J
R 8,18	2	2	27kΩ ±5%; 0,25W	B51263-A2275-J
R 9	1	1	47kΩ ±5%; 0,25W	B51263-A2473-J
R 10,20	2	2	10kΩ ±5%; 0,25W	B51263-A2103-J

2a 2b

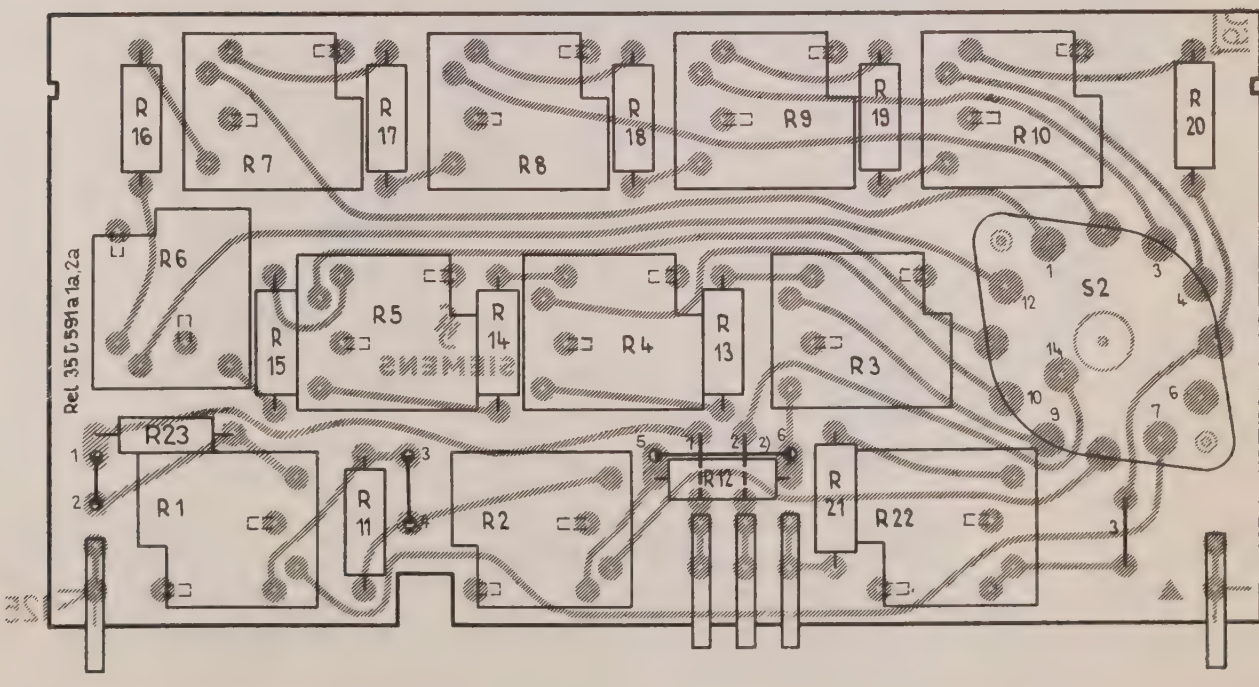
			Schichtwiderstand LAYER-TYPE RESISTOR	
R 19	1	1	47kΩ ±5%; 0,1W	B 51261 B 47 K 5/2
R 21	1	-	2kΩ ±5%; 0,25W	B51263-A2202-J
Ts 1,2 3,4	4	4	Transistor TRANSISTOR	AFY 24
Ü 1,2	2	2	Schalenkernspule POT-CORE COIL Wicklg. I (ge/rt) 140 Wdg 0,10 CuL; 13Ω Wicklg. II (bl/ws) 99 Wdg 0,07 CuL 18Ω Wicklg. III (br/gn) 32 Wdg 0,07 CuL 6Ω	Rel Bv 622 T 3132



Verstärkerplatte Rel ms 35 D 590a2a, 2b (Ausgabe III)
AMPLIFIER BOARD Rel ms 35 D 590a2a, 2b (ISSUE III)

Meßlinienteiler Rel 35 D 591a 1a,2a (Ausgabe I)
MEASURING-LINE DIVIDER (ISSUE I)

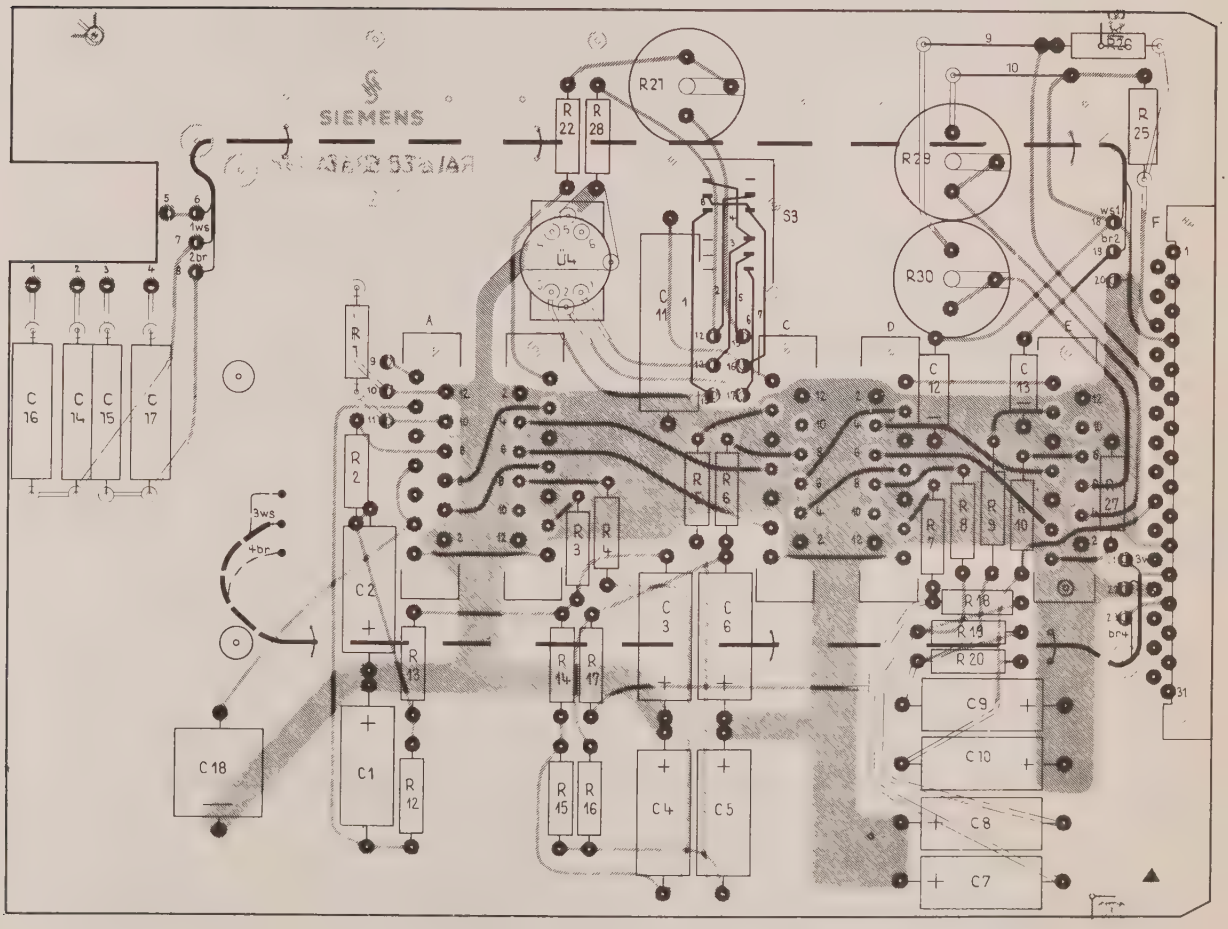
	Ausfg. MODEL 1a	2a		
			Schichtdrehwiderstand LAYER-TYPE VAR RESISTOR	
R 1-10	10	10	500Ω lin 0,1W	500 Ω lin Rel Bv 613 C 3007a1
R 22	1	1	2kΩ lin 0,1W	2 kΩ lin Rel Bv 613 C 3007a1
			Schichtwiderstand LAYER-TYPE RESISTOR	
R 11	1	1	220Ω ±1%; 0,1W	B51263-A9221-F
R 12	1	1	270Ω ±1%; 0,1W	B51263-A9271-F
R 13-19	7	7	390Ω ±1%; 0,1W	B51263-A9391-F
R 20,23	2	2	680Ω ±1%; 0,1W	B51263-A9681-F
R 21	1	1	3kΩ ±2%; 0,25W	B51263-A2302-G
S 2	1	1	Drehschalter(Rel sch 175) ROTARY SWITCH 1polig; 1 Ebene; 12 Stellungen 1-POLE; 1-DECK; 12-POSITIONS	C44315-A14-A3



Messlinienteiler — Rel ms 35 D 591a 1a, 2a (Ausgabe I)
MEASURING-LINE DIVIDER — Rel ms 35 D 591a 1a, 2a (ISSUE I)

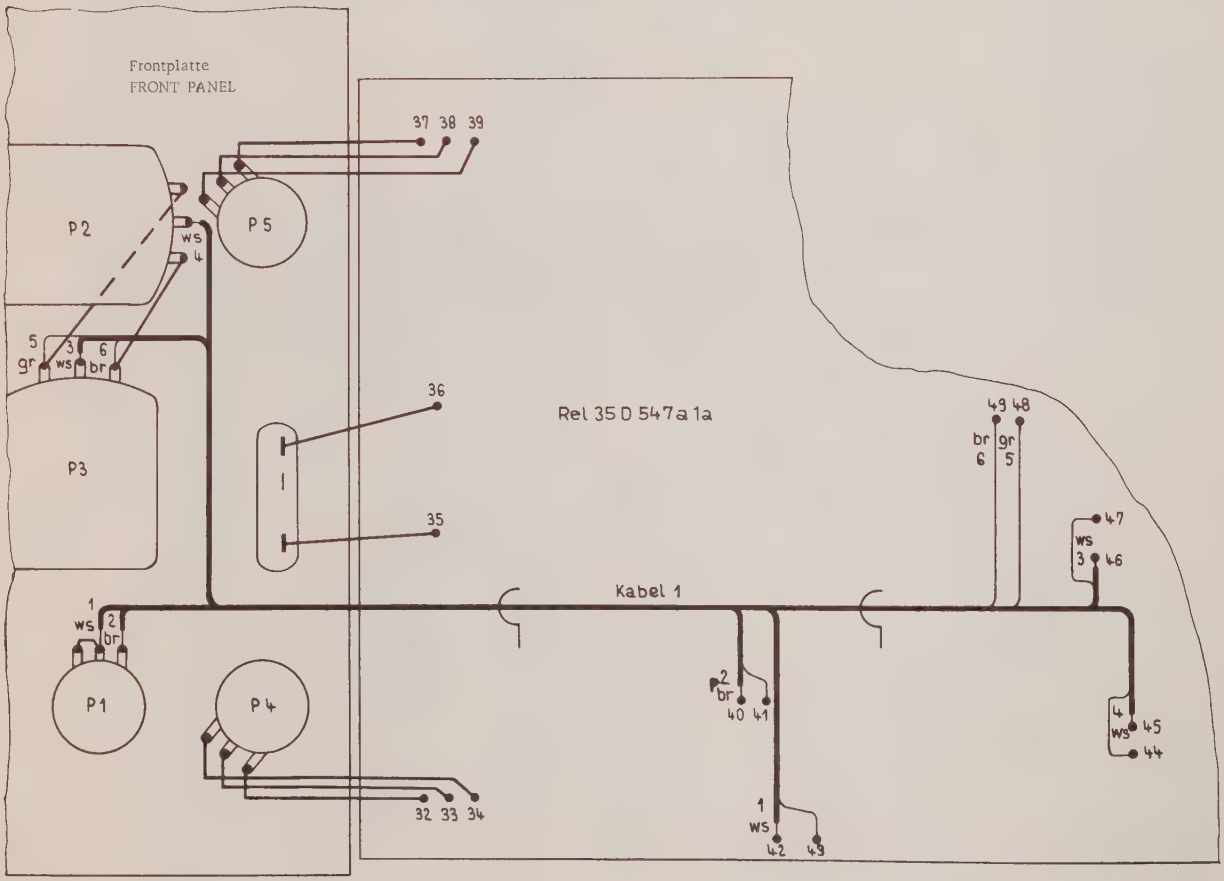
	Aufnahmeplatte Rel 35 D 592a,2a MOUNTING PLATE		(Ausgabe I) (ISSUE I)
C 1-10	10	Elektrolyt-Kondensator ELECTROLYTIC CAPACITOR 10µF +50/-20%; 35V-	B41951-A7106-S
		Styroflex-Kondensator STYROFLEX CAPACITOR	
C 11	1	16000pF ±1%; 125V-	B31073-A1163-F
C 12,13	2	1000pF ±20%; 500V-	B31140-A5102-M
C 18	1	5000pF ±20%; 500V-	B31141-A5502-M
C 14,15	2	MKH-Kondensator MKH-CAPACITOR 0,01µF ±20%; 250V-	B32220-J3103-M
C 16,17	2	MKL-Kondensator MKL-CAPACITOR 0,1µF ±20%; 250V-	B32110-C2104-M
		Schichtwiderstand LAYER-TYPE RESISTOR	
R 1	1	1,575kΩ ±1%; 0,1W	B51263-A9152-F750
R 2,12-20	10	39Ω ±5%; 0,25W	B51263-A2390-J
R 3	1	120Ω ±5%; 0,25W	B51263-A2121-J
R 4	1	220Ω ±5%; 0,25W	B51263-A2221-J
R 5	1	390Ω ±5%; 0,25W	B51263-A2391-J
R 6	1	560Ω ±5%; 0,25W	B51263-A2561-J
R 7	1	820Ω ±5%; 0,25W	B51263-A2821-J
R 8	1	1,2kΩ ±5%;0,25W	B51263-A2122-J
R 9	1	1,5kΩ ±5%;0,25W	B51263-A2152-J
R 10	1	1,8kΩ ±5%;0,25W	B51263-A2182-J
R 22	1	300Ω ±5%; 0,25W	B51263-A2301-J
R 25,26	2	220kΩ ±5%;0,25W	B51263-A2224-J
R 27	1	2kΩ ±5%; 0,25W	B51263-A2202-J
R 28	1	10kΩ ±5%;0,25W	B51263-A2103-J
		Schichtdrehwiderstand LAYER-TYPE VAR RESISTOR	
R 21	1	200Ω lin 0,1W	200 Ω lin Rel wd 146d
R 29,30	2	500kΩ lin 0,1W	500 kΩ lin Rel wd 146d

S 3	1	Drehschalter ROTARY SWITCH 3polig; 1 Ebene; 3 Stellungen 3-POLE; 1-DECK; 3-POSITIONS	Rel sch 197p Tz 1
Ü 4	1	Schalenkernspule POT-CORE COIL Wicklg. I (ge,rt,gn,sw) 76 Wdg 0,25 CuL 0,8Ω 1. Abgriff: 19 Wdg 2. Abgriff: 38 Wdg	Rel Bv 622 W 3054



Aufnahmeplatte — Rel ms 35 D 592a2a (Ausgabe III)
MOUNTING PLATE — Rel ms 35 D 592a2a (ISSUE III)

	1	Verstärkerplatte AMPLIFIER BOARD	Rel Sk 35 D 547a1a	5-67
		Schichtdrehwiderstand LAYER-TYPE VAR RESISTOR		
P 1	1	10kΩ lin; 0,2W	10 kΩ lin Rel TL 613c 3003a3	
P 2,3	2	100kΩ lin; 0,4W	100 kΩ lin Rel wd 152b	
P 4	1	100kΩ lin; 0,2W	100kΩ lin Rel TL 613c 3003a3	
P 5	1	5kΩ lin; 0,2W	5 kΩ lin Rel TL 613c 3003a3	



Frequenzmarken-Einschub Rel ms 3 D 928a1a (Ausgabe III)
FREQUENZMARKER SLIDE-IN CHASSIS Rel ms 3 D 928a1a (ISSUE III)

		Styroflex-Kondensator **STYROFLEX CAPACITOR**	
C 1,2	2	1000pF ±10%; 125V-	B31140-A1102-K
C 5	1	500pF ±20%; 125V-	B31142-A5501-M
C 6,16	2	1000pF ±20%; 125V-	B31140-A1102-M
C 7	1	5000pF ±20%; 125V-	B31142-A1502-M
C 8	1	5000pF ±20%; 250V-	B31142-A2502-M
C 9	1	1000pF ±20%; 500V-	B31142-A5102-M
C 11	1	10pF ±1%; 500V-	B31141-A5100-F
C 12	1	200pF ±20%; 500V-	B31141-A5201-M
C 15	1	250pF ±5%; 125V-	B31140-A1251-J
C 32	1	100pF ±20%; 500V-	B31141-A5101-M
		Elektrolyt-Kondensator **ELECTROLYTIC CAPACITOR**	
C 3,37	2	10µF +50/-20%; 35V-	B41951-A7106-S
C 4	1	8µF +50/-10%; 150V-	V43711-A1805-T
C 10,14 19,21	4	4µF +50/-10%; 150V-	B43711-A1405-T
C 34	1	2µF +50/-20%; 35V-	B41951-A7205-S
C 38	1	1µF +50/-10%; 350V-	B43711-A4105-T
		MKL-Kondensator **MKL-CAPACITOR**	
C 13,17	2	0,1µF ±20%; 100V-	B32110-C0104-M
C 20	1	1µF ±20%; 160V-	B32110-C1105-M
C 35,36	2	2,2µF ±20%; 63V-	B32110-C9225-M
C 31,33	2	**MKH-Kondensator** **MKH-CAPACITOR** 0,1µF ±20%; 300V-	B32220-A3104-M
		Richtleiter **CRYSTAL DIODE**	
Gr 1-6	6	J_D = 75mA; U_{Sp} = 25V	AAY 26
Gr 9,10 15,16	4	Germanium-Diode GERMANIUM DIODE	AAY 29

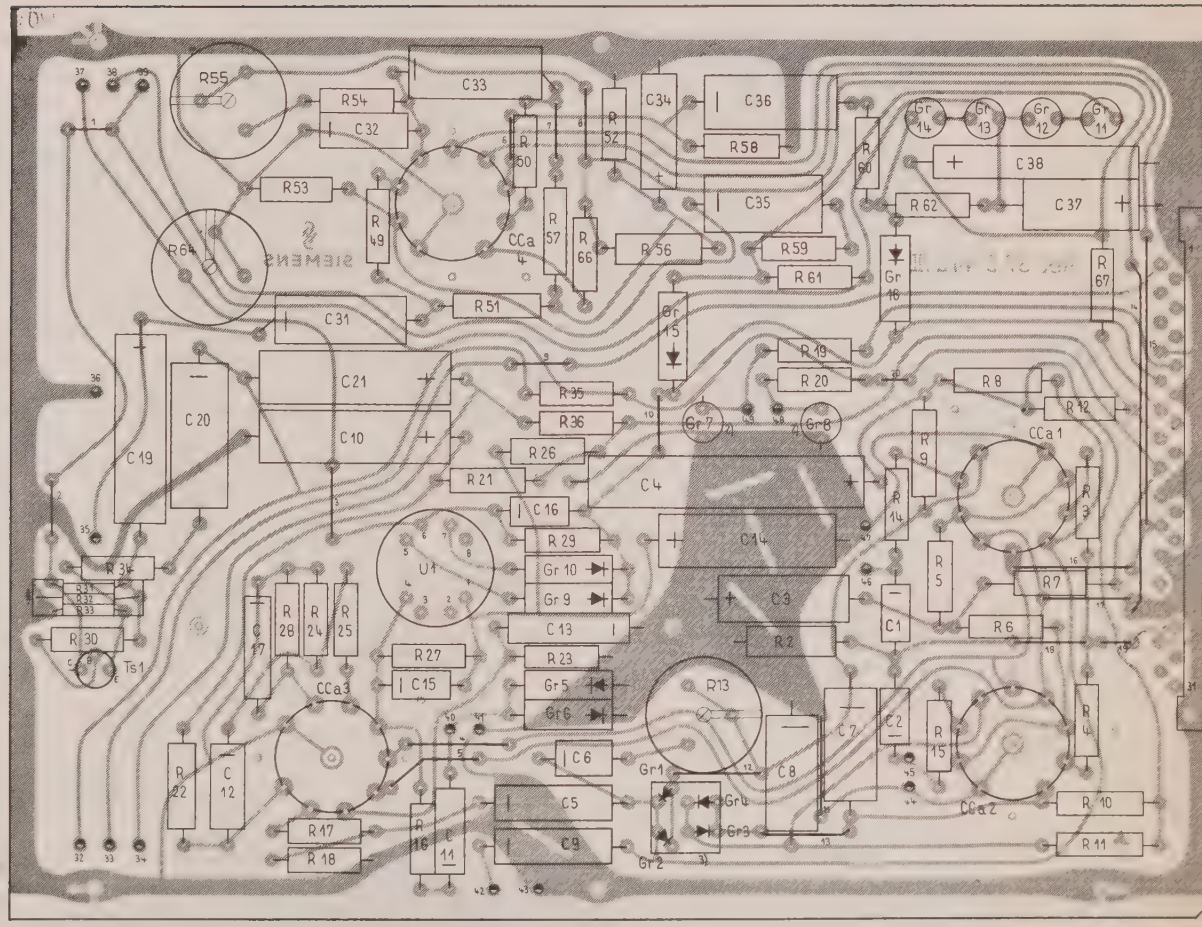
		Silizium-Zenerdiode SILICON-ZENER DIODE	
Gr 7,8	2	J_Z=5mA; U_Z=11V; r_Z=20Ω	Sz 11 KB
Gr 11-14	4	J_Z=5mA; U_Z=6,2V; r_Z=40Ω	Sz 6 KB
		Schichtwiderstand LAYER-TYPE RESISTOR	
R 2	1	1MΩ ±5%; 0,33W	B 51264 A 1 M 5/2
R 3,4,7,14 15,17,25,49 50,67	10	100Ω ±5%; 0,25W	
R 5,6,54	3	4kΩ ±5%; 0,25W	B51263-A2402-J
R 8,9,10 11,22	5	10kΩ ±5%; 0,33W	B 51264 A 10 K 5/2
R 12	1	500Ω ±5%; 0,25W	B51263-A2501-J
R 16,34	2	10kΩ ±5%; 0,25W	B51263-A2103-J
R 18	1	100kΩ ±5%; 0,25W	B51263-A2104-J
R 19,29	2	50kΩ ±5%; 0,25W	B51263-A2503-J
R 20	1	12kΩ ±5%; 0,25W	B51263-A2123-J
R 21	1	2kΩ ±5%; 0,25W	B51263-A2202-J
R 23,28	2	250Ω ±5%; 0,25W	B51263-A2251-J
R 24	1	200kΩ ±5%; 0,25W	B51263-A2204-J
R 26,53 58,66	4	5kΩ ±5%; 0,25W	B51263-A2502-J
R 27	1	1kΩ ±5%; 0,15W	B51263-A2102-J
R 30,33	2	3,3kΩ ±5%; 0,25W	B51263-A2332-J
R 31,61,62	3	20kΩ ±5%; 0,25W	B51263-A2203-J
R 32	1	22kΩ ±5%; 0,25W	B51263-A2223-J
R 35	1	12kΩ ±5%; 0,25W	B51263-A2123-J
R 36	1	60kΩ ±5%; 0,25W	B51263-A2603-J
R 51,57	2	500kΩ ±5%; 0,33W	B51264 A 500 K 5/2
R 52	1	30kΩ ±5%; 0,25W	B51263-A2303-J
R 56	1	400kΩ ±5%; 0,33W	B51264 A 400 K 5/2
R 59,60	2	800Ω ±5%; 0,25W	B51263-A2801-J
		Schichtdrehwiderstand LAYER-TYPE VAR RESISTOR	
R 13	1	10kΩ lin; 0,1W	10 kΩ lin Rel wd 146d
R 55	1	1kΩ lin; 0,1W	1 kΩ lin Rel wd 146d
R 64	1	5kΩ lin; 0,1W	5 kΩ lin Rel wd 146d

TRANSISTOR

Ü 1	1	Übertrager (9 Rel sp 5u) TRANSFORMER	Rel Bv 622 N 3447

Wicklg. I (1,4)
20 Wdg 0,40 Cu2L 0,12Ω
280-530µH

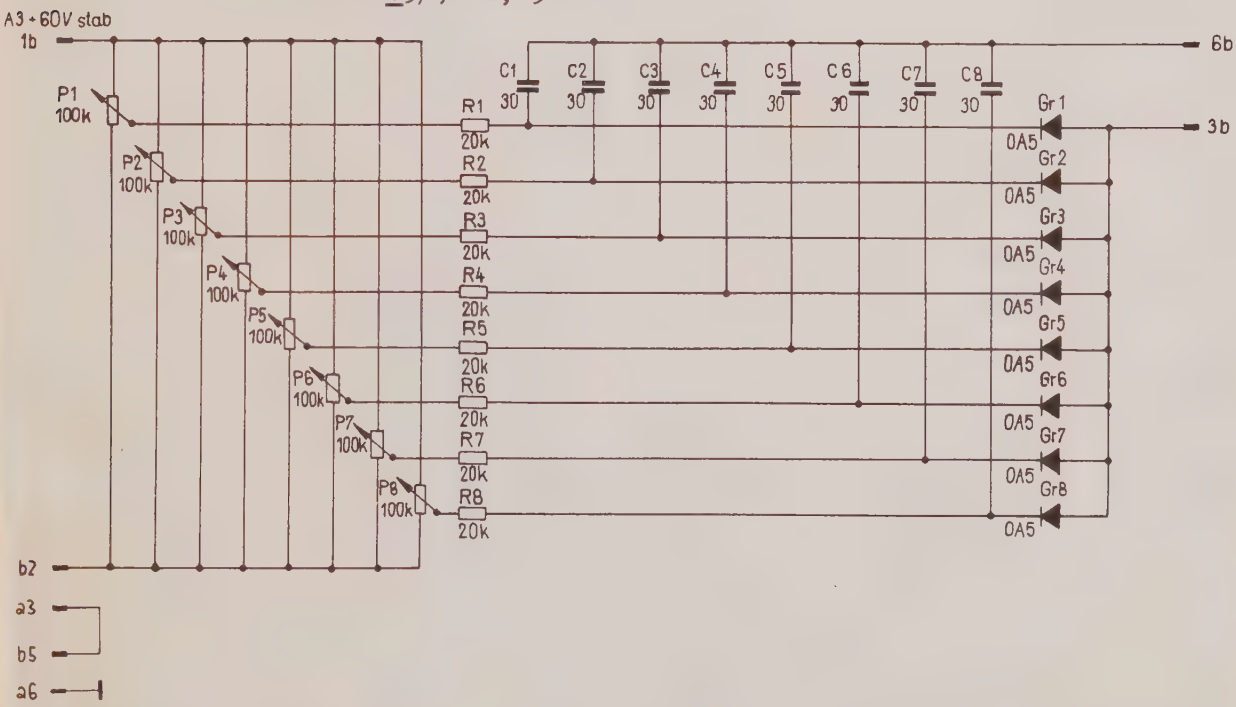
Wicklg. II (5,6,7)
40 Wdg 0,28 Cu2L 0,48Ω
1. Abgriff (6): 20 Wdg

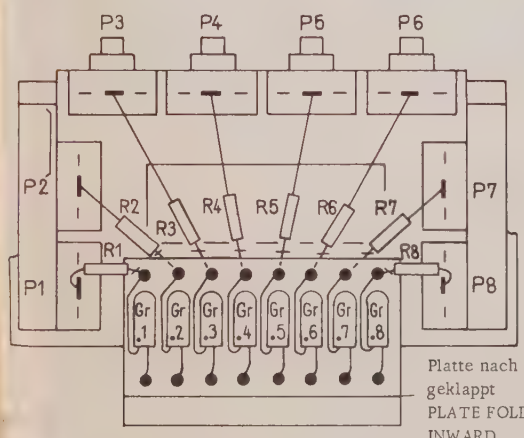


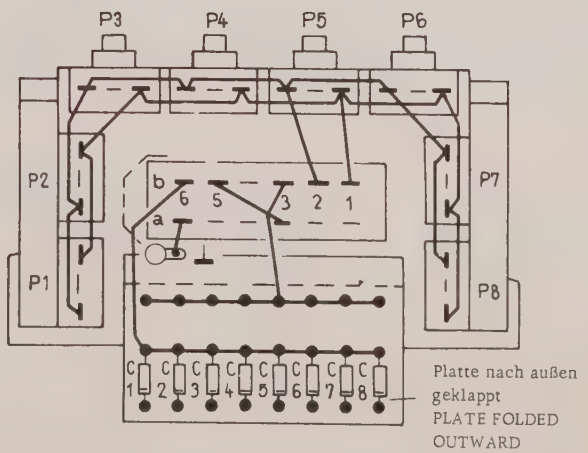
Verstärkerplatte — Rel ms 35 D 547a1a (Ausgabe III)
AMPLIFIER BOARD — Rel ms 35 D 547a1a (ISSUE III)

Rastgeber Rel 3 B 945a1a (Ausgabe II)
LEVEL PATERN SENDER (ISSUE II)

C 1-8	8	Styroflex-Kondensator STYROFLEX CAPACITOR 30pF ±1pF; 125V-	B31140-A1300-A
Gr 1-8	8	Germanium-Diode GERMANIUM DIODE J_D = 200mA; U_{Sp} = 100V-	OA5 (Fa. Valvo)
P 1-8	8	Schichtdrehwiderstand LAYER-TYPE VAR RESISTOR 100kΩ lin; 0,1W	100 kΩ lin Rel TL 613c
R 1-8	8	Schichtwiderstand LAYER-TYPE RESISTOR 20kΩ ±5%; 0,15W	B51262-A2203-J

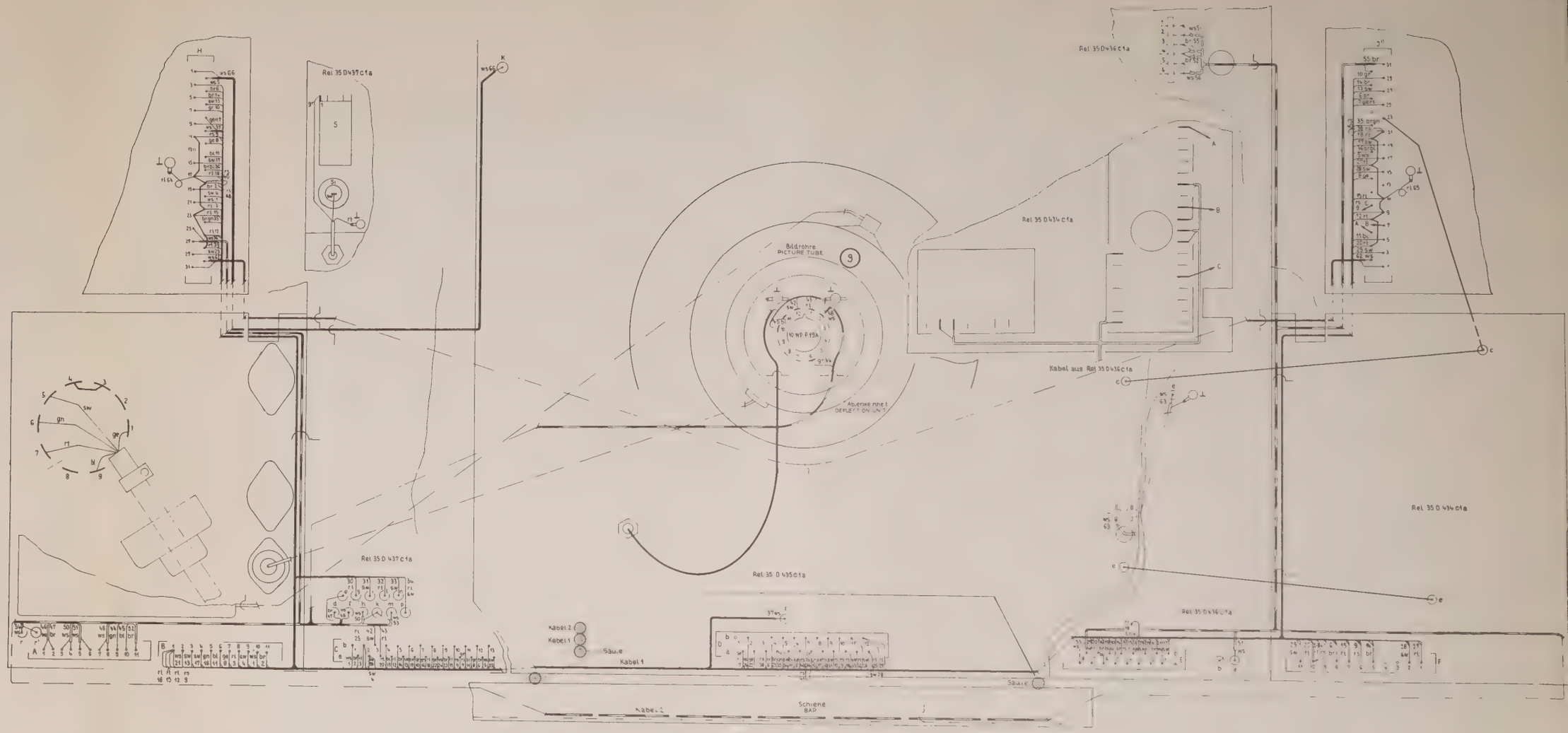






Rastgeber Rel str, ms 3 B 945a1a (Ausgabe I)
LEVEL PATERN SENDER Rel str, ms 3 B 945a1a (ISSUE I)

SIEMENS



Pegelbildgerät
LEVEL TRACER

Rel ms 3 D 346c1a dt/er

Ausgabe I 6.7.66 Br

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SIEMENS AKTIENGESELLSCHAFT

Re
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C

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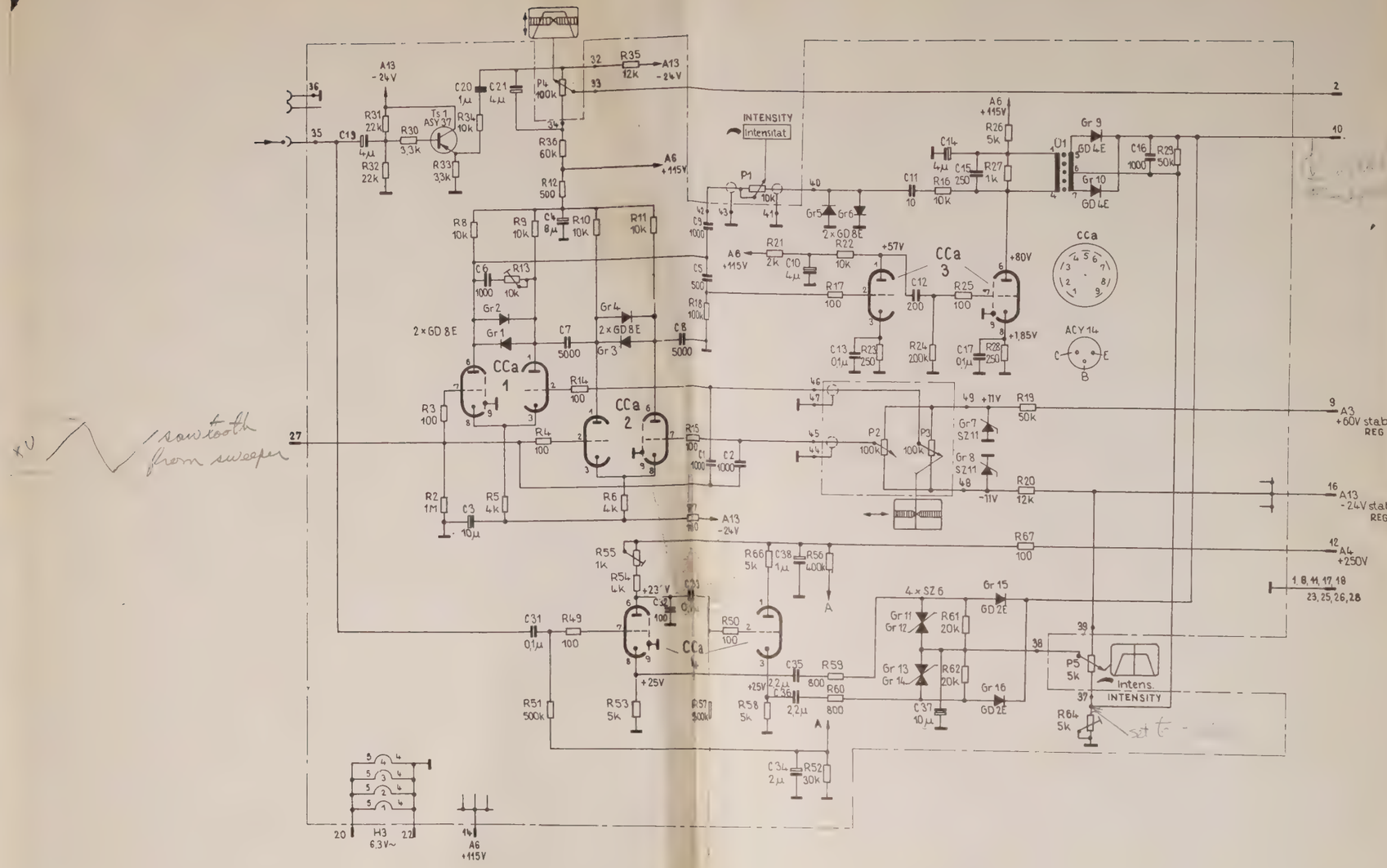

Frequenzmarken-Einschub
FREQUENCY MARKER SLIDE-IN CHASSIS

Rel str 3 D 928a1a dt/en

Ausgabe III 1.65 Br

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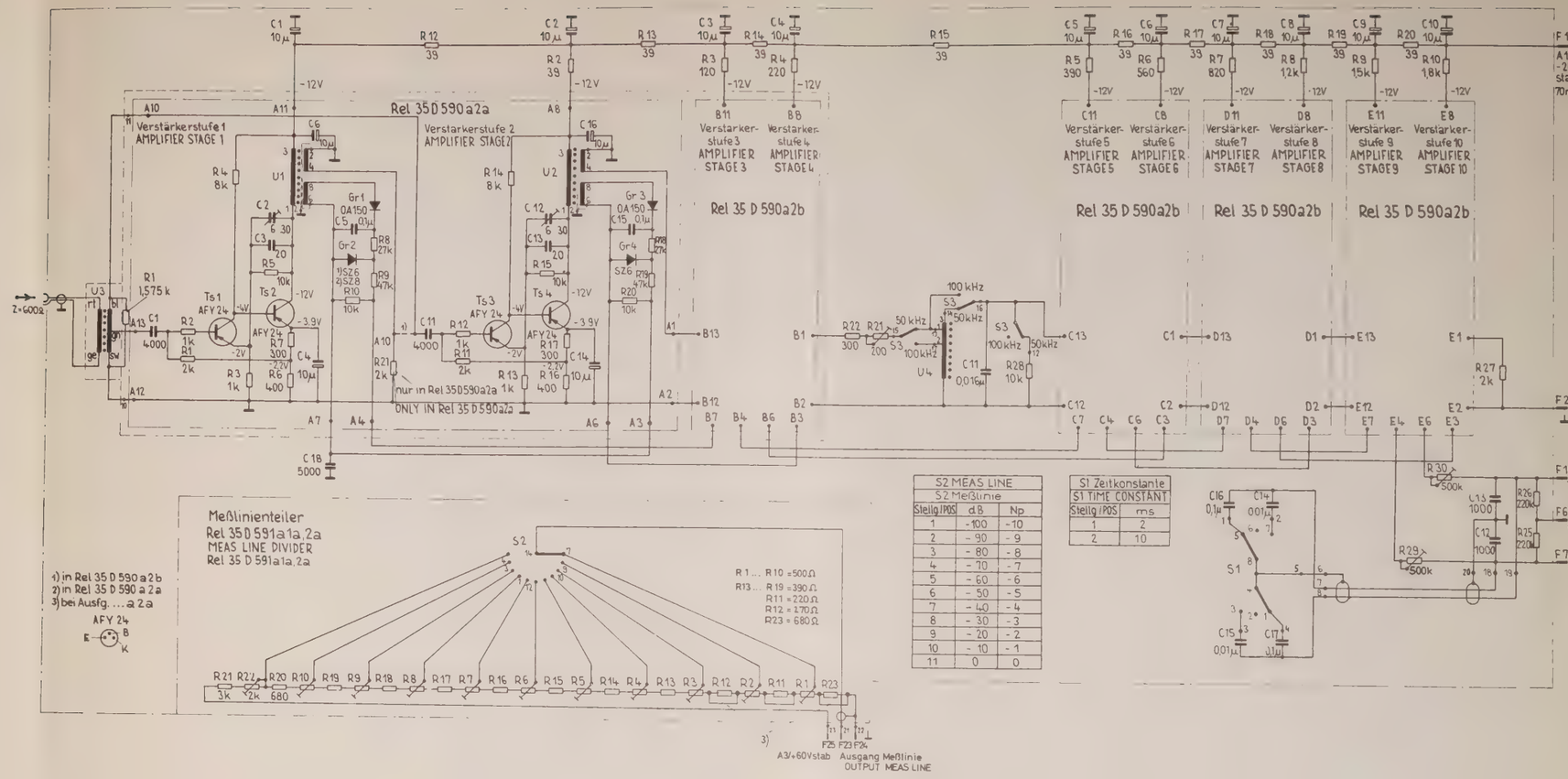

Meßlinienteiler
Rel 35 D 591a1a,2a
MEAS LINE DIVIDER
Rel 35 D 591a1a,2a
1) in Rel 35 D 590 a 2 b
2) in Rel 35 D 590 a 2 a
3) bei Ausfg. ....a 2 a
R1 ... R10 = 500Ω
R13 ... R19 = 390Ω
R11 = 220Ω
R12 = 270Ω
R23 = 680Ω
A3/+60Vstab Ausgang Meßlinie
OUTPUT MEAS LINE

S2 MEAS LINE S2 Meßlinie		
Stellg/POS	dB	Np
1	-100	-10
2	- 90	- 9
3	- 80	- 8
4	- 70	- 7
5	- 60	- 6
6	- 50	- 5
7	- 40	- 4
8	- 30	- 3
9	- 20	- 2
10	- 10	- 1
11	0	0

S1 Zeitkonstante S1 TIME CONSTANT	
Stellg/POS	ms
1	2
2	10

Logarithmischer ZF Verstärker
LOGARITHMIC IF AMPLIFIER

Rel str 3 D 920a1a, 2a dt/en

Ausgabe III 1.9.66 Br

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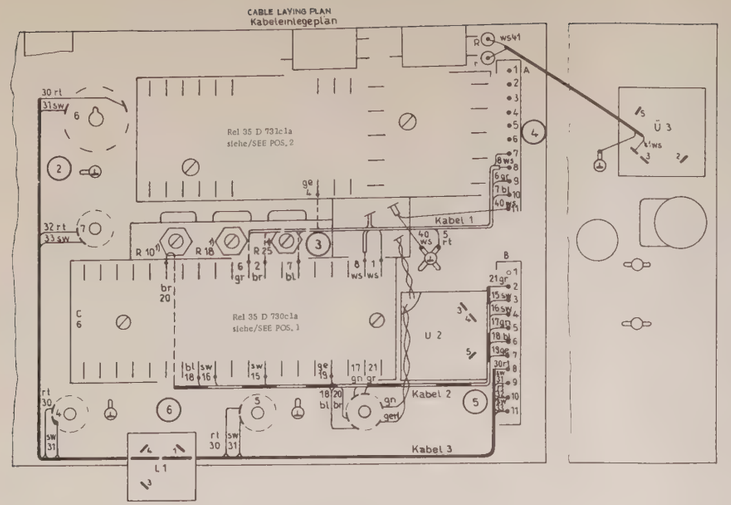

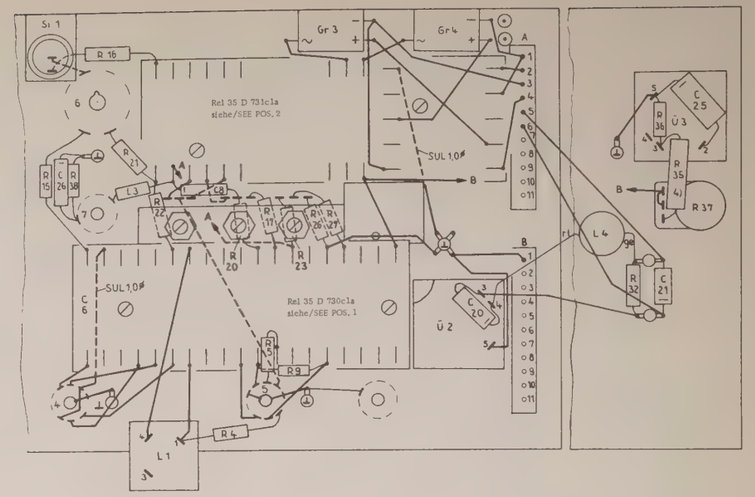

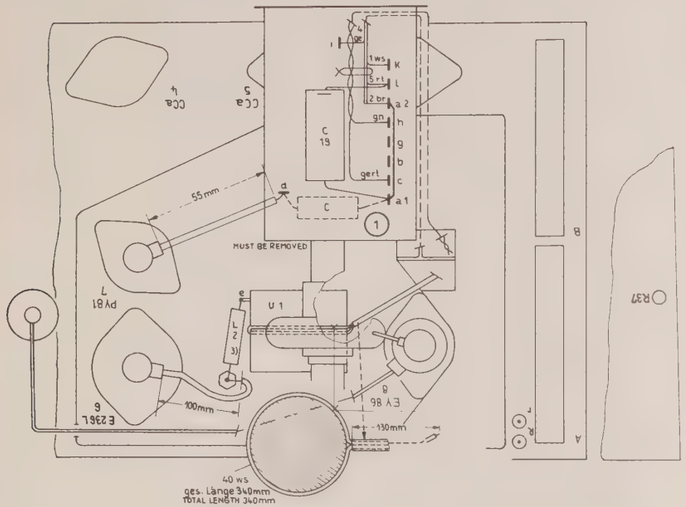

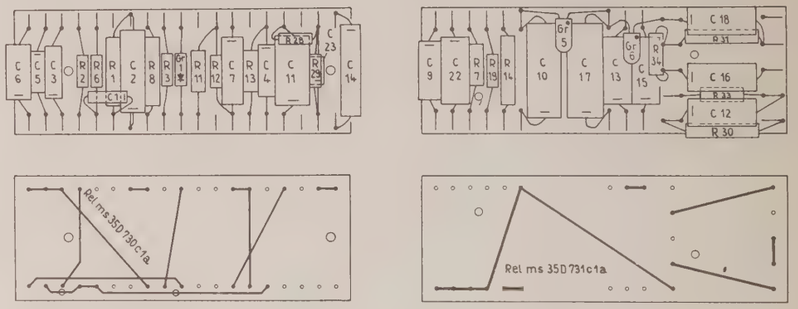

Pos. 1
Rel ms 35 D 730c1a

Pos. 2
Rel ms 35 D 731c1a

Hochspannungsteil
HIGH-VOLTAGE SECTION

Rel ms 35 D 433c1a dt/en

Ausgabe I 6.7.66 Br

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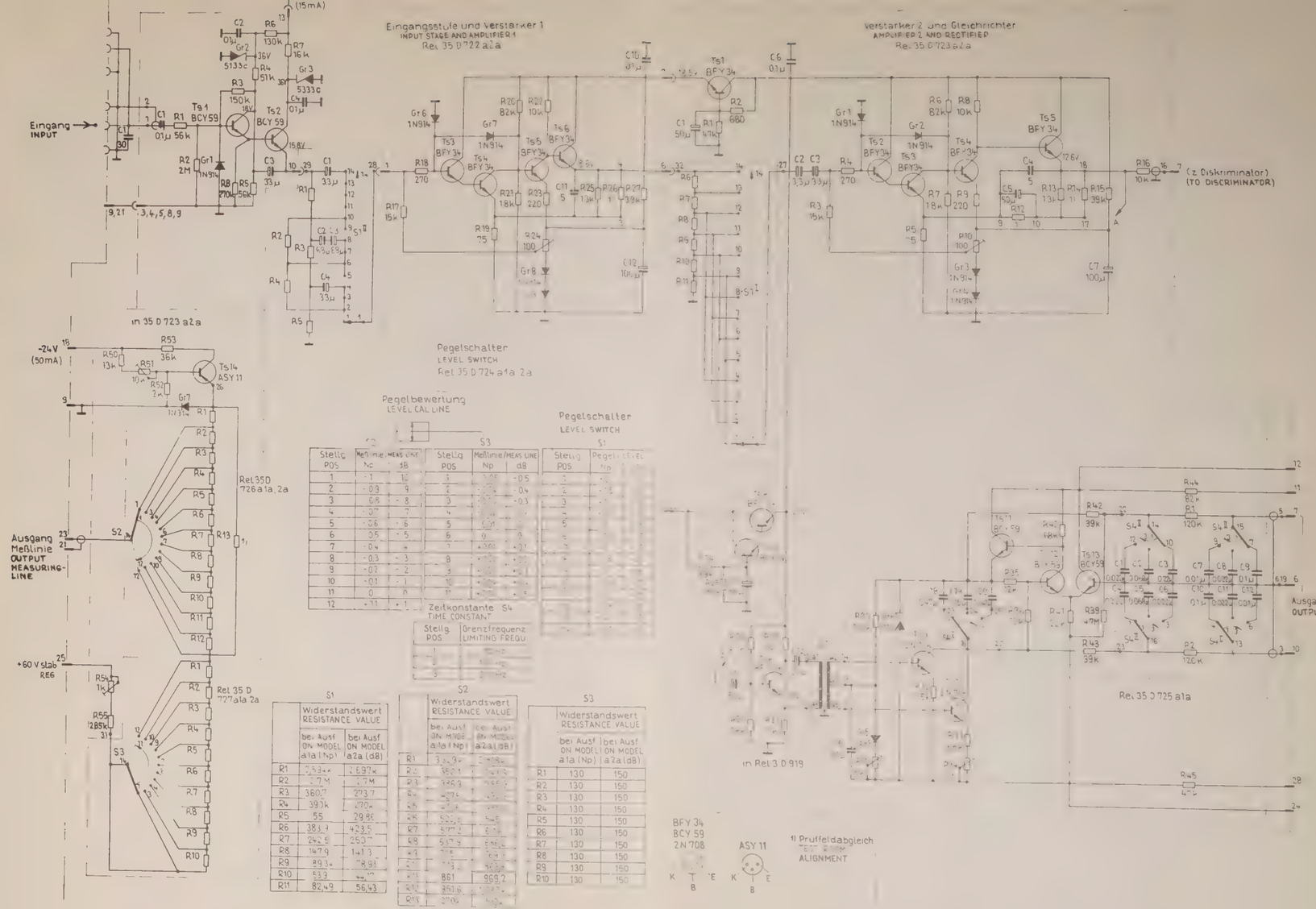

Stellg POS	Meßlinie/MEAS LINE Np	dB
1	-1	1
2	-0,9	0,9
3	-0,8	0,8
4	-0,7	0,7
5	-0,6	0,6
6	-0,5	0,5
7	-0,4	0,4
8	-0,3	0,3
9	-0,2	0,2
10	-0,1	0,1
11	0	0
12	+0,1	+0,1

S3

Stellg POS	Meßlinie/MEAS LINE Np	dB
1		-0,5
2		-0,4
3		-0,3
4		
5		
6	0	0
7		+0,1
8		
9		
10		
11		
12		

S1

Stellg POS	Pegel/LEVEL Np
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	

Stellg POS	Grenzfrequenz LIMITING FREQU
1	
2	
3	

S1

	Widerstandswert RESISTANCE VALUE	
	bei Ausf ON MODEL a1a (Np)	bei Ausf ON MODEL a2a (dB)
R1	0,53+x	0,697k
R2	1,7M	1,7M
R3	360,7	273,7
R4	393k	470k
R5	55	29,8k
R6	383,3	423,5
R7	242,5	260,7
R8	1479	1413
R9	893+	788
R10	533	592
R11	82,49	56,43

S2

	Widerstandswert RESISTANCE VALUE	
	bei Ausf ON MODEL a1a (Np)	bei Ausf ON MODEL a2a (dB)
R1	3,3+x	3,3k
R2	861	969,2
R3	351,6	
R4	200	

S3

	Widerstandswert RESISTANCE VALUE	
	bei Ausf ON MODEL a1a (Np)	bei Ausf ON MODEL a2a (dB)
R1	130	150
R2	130	150
R3	130	150
R4	130	150
R5	130	150
R6	130	150
R7	130	150
R8	130	150
R9	130	150
R10	130	150

Breitbandverstärker 30 Hz bis 30 kHz
WIDEBAND AMPLIFIER 30 Hz TO 30 kHz

Rel str 3 D 919 a1a, a2a dt/en

Ausgabe II 28.9.66 Br.

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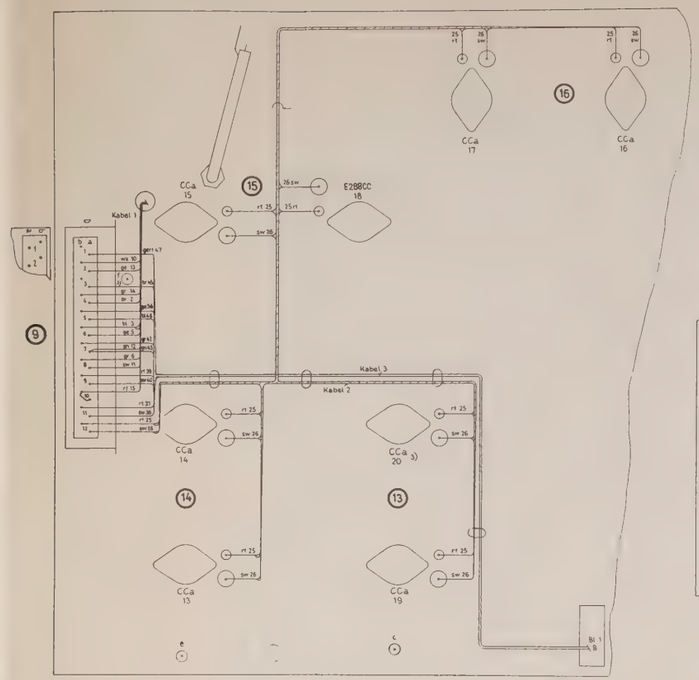

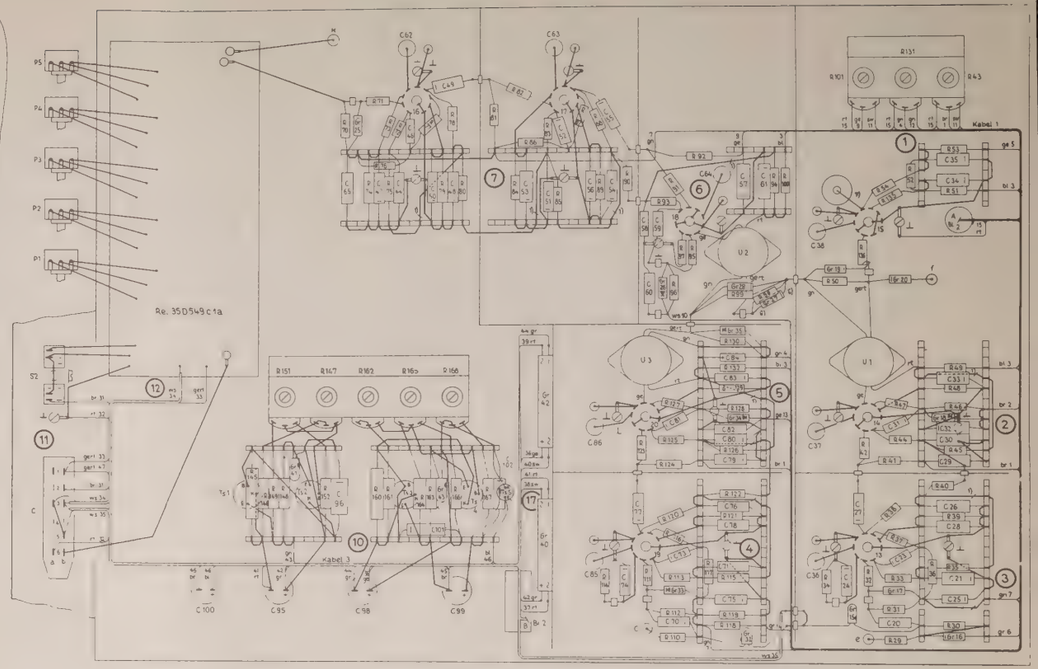

Differenzierverstärker
DIFFERENTIATING AMPLIFIER

Rel ms 35 D 435c1a dt/en

Ausgabe I 6.7.66 Br

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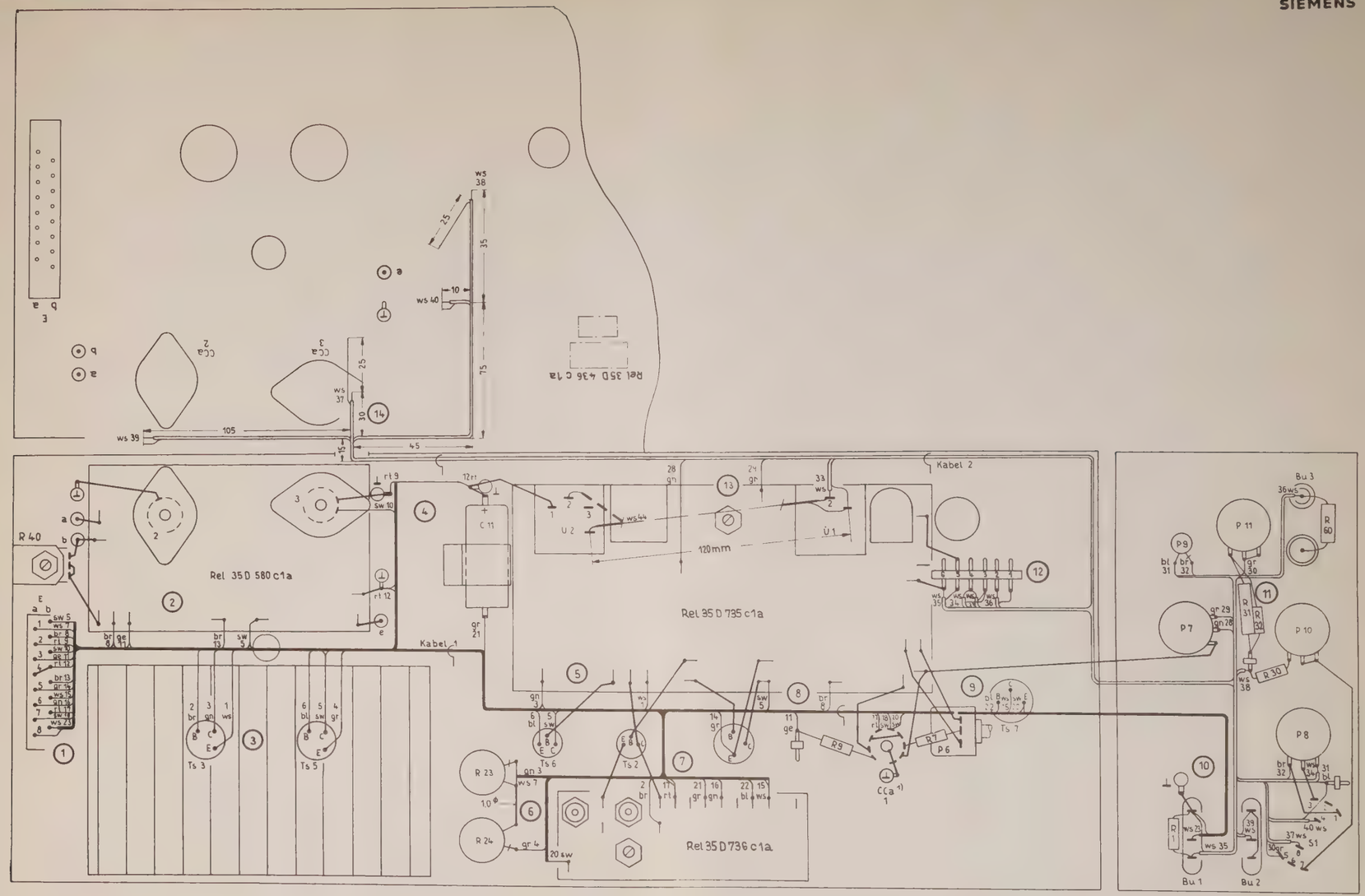

Sägezahn- und Horizontalverstärker
SAWTOOTH AND HORIZONTAL AMPLIFIER

Rel ms 35 D 436c1a dt/en

Ausgabe I 6. 7. 66 Br

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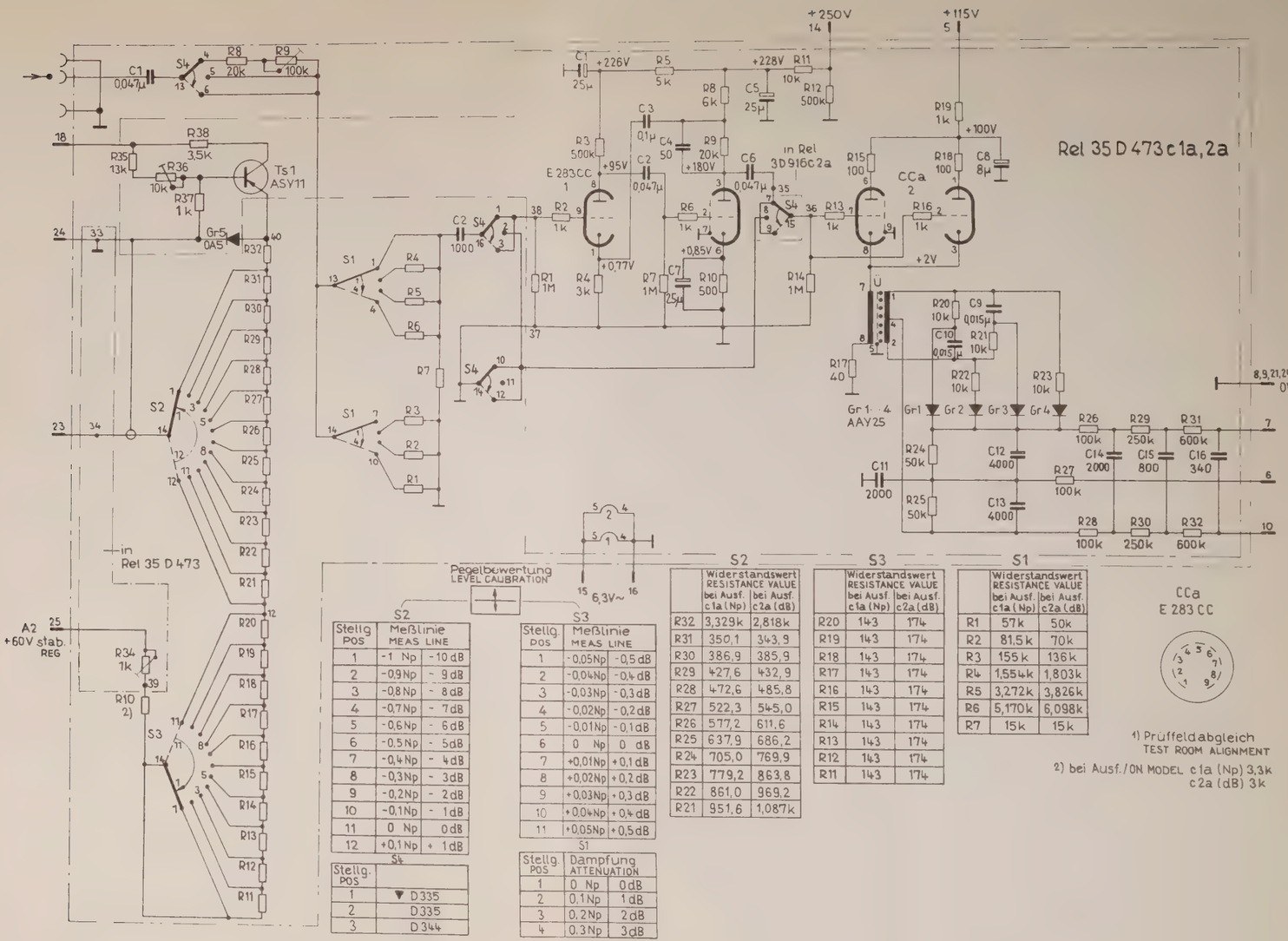

S2 Stellg. POS	Meßlinie MEAS LINE	
1	-1 Np	-10 dB
2	-0,9 Np	- 9 dB
3	-0,8 Np	- 8 dB
4	-0,7 Np	- 7 dB
5	-0,6 Np	- 6 dB
6	-0,5 Np	- 5 dB
7	-0,4 Np	- 4 dB
8	-0,3 Np	- 3 dB
9	-0,2 Np	- 2 dB
10	-0,1 Np	- 1 dB
11	0 Np	0 dB
12	+0,1 Np	+ 1 dB

S4 Stellg. POS	
1	▼ D 335
2	D 335
3	D 344

S3 Stellg. POS	Meßlinie MEAS LINE	
1	-0,05 Np	-0,5 dB
2	-0,04 Np	-0,4 dB
3	-0,03 Np	-0,3 dB
4	-0,02 Np	-0,2 dB
5	-0,01 Np	-0,1 dB
6	0 Np	0 dB
7	+0,01 Np	+0,1 dB
8	+0,02 Np	+0,2 dB
9	+0,03 Np	+0,3 dB
10	+0,04 Np	+0,4 dB
11	+0,05 Np	+0,5 dB

S1 Stellg. POS	Dämpfung ATTENUATION	
1	0 Np	0 dB
2	0,1 Np	1 dB
3	0,2 Np	2 dB
4	0,3 Np	3 dB

S2	Widerstandswert RESISTANCE VALUE bei Ausf. c1a (Np)	bei Ausf. c2a (dB)
R32	3,329k	2,818k
R31	350,1	343,9
R30	386,9	385,9
R29	427,6	432,9
R28	472,6	485,8
R27	522,3	545,0
R26	577,2	611,6
R25	637,9	686,2
R24	705,0	769,9
R23	779,2	863,8
R22	861,0	969,2
R21	951,6	1,087k

S3	Widerstandswert RESISTANCE VALUE bei Ausf. c1a (Np)	bei Ausf. c2a (dB)
R20	143	174
R19	143	174
R18	143	174
R17	143	174
R16	143	174
R15	143	174
R14	143	174
R13	143	174
R12	143	174
R11	143	174

S1	Widerstandswert RESISTANCE VALUE bei Ausf. c1a (Np)	bei Ausf. c2a (dB)
R1	57k	50k
R2	81,5k	70k
R3	155k	136k
R4	1,554k	1,803k
R5	3,272k	3,826k
R6	5,170k	6,098k
R7	15k	15k

CCa
E 283 CC

1) Prüffeldabgleich
TEST ROOM ALIGNMENT

2) bei Ausf./ON MODEL c1a (Np) 3,3k
c2a (dB) 3k

ZF-Verstärker
IF AMPLIFIER

Rel str 3 D 916c1a, 2a dt/en

Ausgabe II 31.8.67 Br

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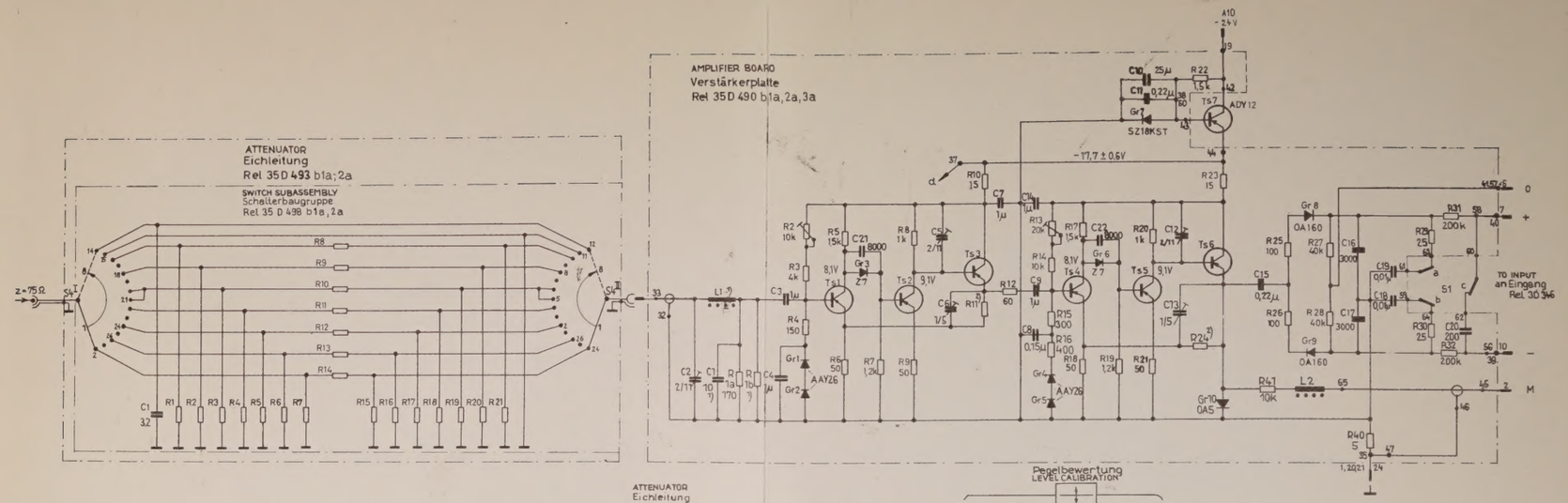

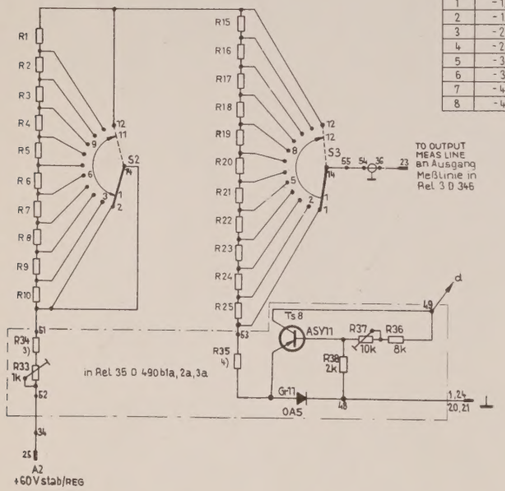

ATTENUATOR
Eichleitung

S4

Stellg POS	Np	dB	dBm
1	- 1,0	- 5	+ 5
2	- 1,5	- 10	0
3	- 2,0	- 15	- 5
4	- 2,5	- 20	- 10
5	- 3,0	- 25	- 15
6	- 3,5	- 30	- 20
7	- 4,0	- 35	- 25
8	- 4,5 ▼II	- 40 ▼II	- 30

S1

Stellg POS	fu =
1	10kHz ▼II
2	100kHz

S2

Stellg POS	Np	dB
1	- 0,05	- 0,5
2	- 0,04	- 0,4
3	- 0,03	- 0,3
4	- 0,02	- 0,2
5	- 0,01	- 0,1
6	0 ▼II	0 ▼II
7	+ 0,01	+ 0,1
8	+ 0,02	+ 0,2
9	+ 0,03	+ 0,3
10	+ 0,04	+ 0,4
11	+ 0,05	+ 0,5

S3

Stellg Pos	Np	dB	dBm
1	- 1,0	- 10	- 10
2	- 0,9	- 9	- 9
3	- 0,8	- 8	- 8
4	- 0,7	- 7	- 7
5	- 0,6	- 6	- 6
6	- 0,5	- 5	- 5
7	- 0,4	- 4	- 4
8	- 0,3	- 3	- 3
9	- 0,2	- 2	- 2
10	- 0,1 ▼II	- 1	- 1 ▼I
11	0	0 ▼II	0
12	+ 0,1	+ 1	+ 1

S4

	Widerstandswert RESISTANCE VALUE bei Ausf. ON MODEL b1a (Np)	bei Ausf. ON MODEL b2a,3a (dB,dBm)
R1	306,22	267,76
R2	162,3	144,5
R3	118,08	107,44
R4	98,48	91,65
R5	88,41	83,94
R6	82,86	79,87
R7	79,67	77,72
R8	39,08	45,59
R9	88,14	106,6
R10	159,7	204,2
R11	272,0	371,0
R12	453,8	664,73
R13	751,3	1183,0
R14	1240,7	2108,0
R15	79,67	77,72
R16	82,86	79,87
R17	88,41	83,94
R18	98,48	91,65
R19	118,08	107,44
R20	162,3	144,5
R21	306,22	267,76

Ts1 - Ts6 = 2N1143 (Fa Texas)

Ts7 = ADY12
Ts8 = ASY11

S2

	Widerstandswert RESISTANCE VALUE bei Ausf. ON MODEL b1a (Np)	bei Ausf. ON MODEL b2a,3a (dB,dBm)
R1	137	167
R2	137	167
R3	137	167
R4	137	167
R5	137	167
R6	137	167
R7	137	167
R8	137	167
R9	137	167
R10	137	167

S3

	Widerstandswert RESISTANCE VALUE bei Ausf. ON MODEL b1a (Np)	bei Ausf. ON MODEL b2a,3a (dB,dBm)
R15	921,6	1,087k
R16	861,0	969,2
R17	779,2	863,8
R18	705,0	769,9
R19	637,9	686,2
R20	577,2	611,6
R21	522,3	545,0
R22	472,6	485,8
R23	427,6	432,9
R24	386,9	385,9
R25	350,1	343,9

1) Prüffeldabgleich
TEST ROOM ALIGNMENT

2) für Ausführung / FOR MODEL b1a, 2a (Np, dB) 920Ω
" " " b3a (dBm) 860Ω
3) " " " b1a (Np) 3,3k
" " " b2a, 3a (dB, dBm) 3k
4) " " " b1a (Np) 3,329k
" " " b2a, 3a (dB, dBm) 2,818k

Breitbandverstärker 10 kHz bis 17 MHz
WIDEBAND AMPLIFIER 10 kHz TO 17 MHz

Rel str 3 D 917 b1a, 2a, 3a dt/en

Ausgabe III 31.8.67 Br

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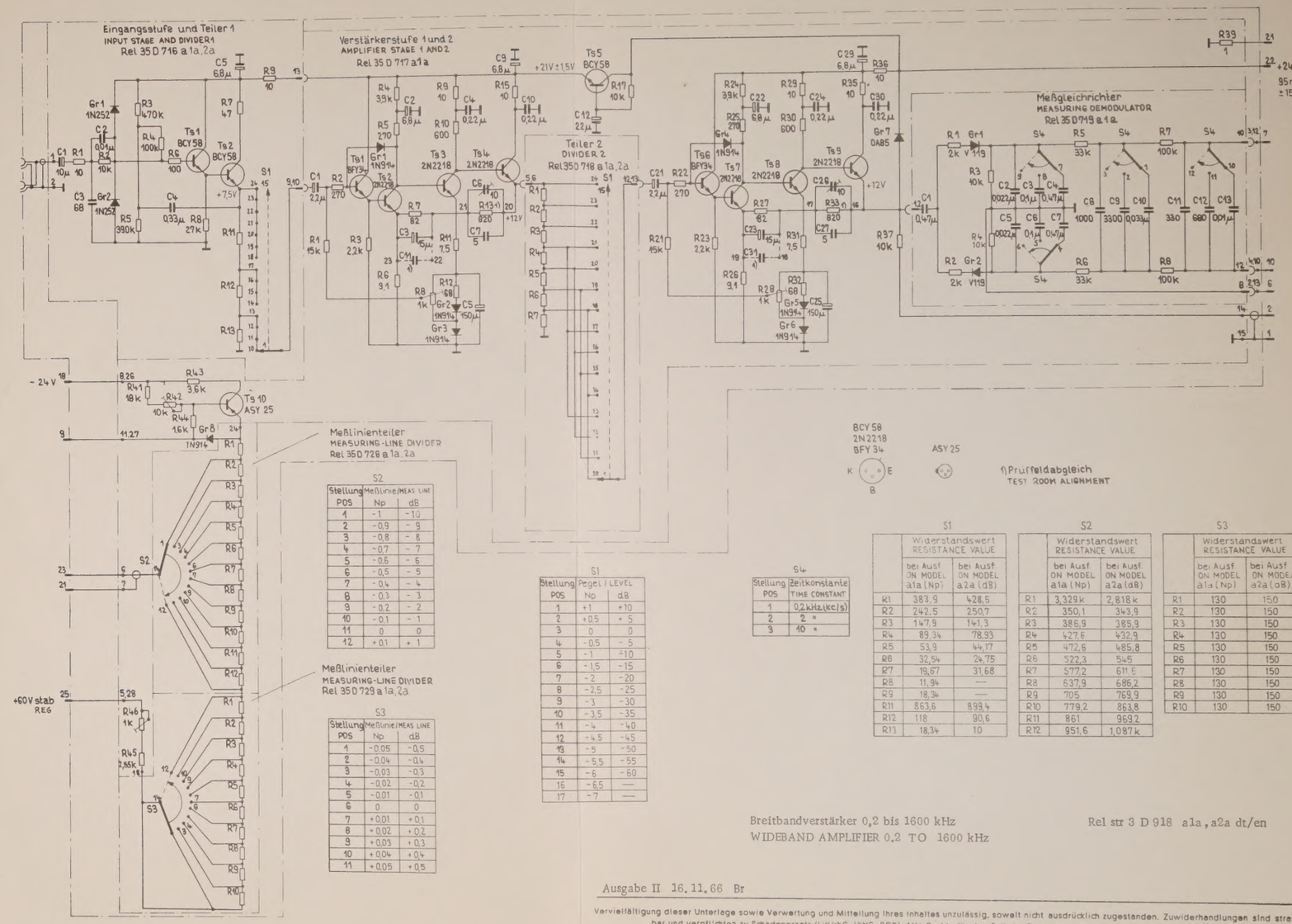

S2

Stellung POS	Meßlinie/MEAS. LINE Np	dB
1	-1	-10
2	-0,9	- 9
3	-0,8	- 8
4	-0,7	- 7
5	-0,6	- 6
6	-0,5	- 5
7	-0,4	- 4
8	-0,3	- 3
9	-0,2	- 2
10	-0,1	- 1
11	0	0
12	+0,1	+ 1

S3

Stellung POS	Meßlinie/MEAS. LINE Np	dB
1	-0,05	-0,5
2	-0,04	-0,4
3	-0,03	-0,3
4	-0,02	-0,2
5	-0,01	-0,1
6	0	0
7	+0,01	+0,1
8	+0,02	+0,2
9	+0,03	+0,3
10	+0,04	+0,4
11	+0,05	+0,5

S1

Stellung POS	Pegel / LEVEL Np	dB
1	+1	+10
2	+0,5	+ 5
3	0	0
4	-0,5	- 5
5	-1	-10
6	-1,5	-15
7	-2	-20
8	-2,5	-25
9	-3	-30
10	-3,5	-35
11	-4	-40
12	-4,5	-45
13	-5	-50
14	-5,5	-55
15	-6	-60
16	-6,5	—
17	-7	—

S4

Stellung POS	Zeitkonstante TIME CONSTANT
1	0,2 kHz (kc/s)
2	2 "
3	10 "

S1

	Widerstandswert RESISTANCE VALUE bei Ausf. ON MODEL a1a (Np)	bei Ausf. ON MODEL a2a (dB)
R1	383,9	428,5
R2	242,5	250,7
R3	147,9	141,3
R4	89,34	78,93
R5	53,9	44,17
R6	32,54	24,75
R7	19,67	31,68
R8	11,94	—
R9	18,34	—
R11	863,6	899,4
R12	118	90,6
R13	18,34	10

S2

	Widerstandswert RESISTANCE VALUE bei Ausf. ON MODEL a1a (Np)	bei Ausf. ON MODEL a2a (dB)
R1	3,329 k	2,818 k
R2	350,1	343,9
R3	386,9	385,9
R4	427,6	432,9
R5	472,6	485,8
R6	522,3	545
R7	577,2	611,6
R8	637,9	686,2
R9	705	769,9
R10	779,2	863,8
R11	861	969,2
R12	951,6	1,087 k

S3

	Widerstandswert RESISTANCE VALUE bei Ausf. ON MODEL a1a (Np)	bei Ausf. ON MODEL a2a (dB)
R1	130	150
R2	130	150
R3	130	150
R4	130	150
R5	130	150
R6	130	150
R7	130	150
R8	130	150
R9	130	150
R10	130	150

Breitbandverstärker 0,2 bis 1600 kHz
WIDEBAND AMPLIFIER 0,2 TO 1600 kHz

Rel str 3 D 918 a1a, a2a dt/en

Ausgabe II 16.11.66 Br

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